

THE PHILIPPINE JOURNAL OF SCIENCE

VOL. 50

FEBRUARY, 1933

No. 2

MORE FRESH-WATER SPONGES FROM THE PHILIPPINES

By N. GIST GEE

Of Yenching University

Through the continued interest and kindness of Mr. R. C. McGregor, of the Bureau of Science, collections of fresh-water sponges, all made by Mr. A. C. Duyag at the following places on Luzon, Philippine Islands, have been submitted to me for examination, and I have found the species indicated below from the several localities.

1. March 17, 1932. Santa Agua, San Francisco del Monte, Rizal Province, *Spongilla fragilis* var. *decipiens*.

2. March 22, 1932. Morong, Rizal Province. "In a small river." *Spongilla fragilis* var. *decipiens* and *Ephydatia fortis* var. *vorstmani*.

3. March 23, 1932. Cardona, Rizal Province. "From the large lake, Laguna de Bay." *Spongilla fragilis* var. *decipiens*, *Spongilla fragilis*, and *Ephydatia fortis* var. *vorstmani*.

4. April 1 and 2, 1932. Lake Bunot, near San Pablo, Laguna Province. "A small crater lake." *Spongilla fragilis* var. *decipiens*.

5. April 3 and 4, 1932. Lake Calibato, near San Pablo, Laguna Province. *Spongilla fragilis* var. *decipiens* and *Ephydatia fortis* var. *vorstmani*.

6. April 5, 1932. Lake Pandin, near San Pablo, Laguna Province. *Spongilla fragilis* var. *decipiens* and *Trochospongilla latouchiana*.

7. April 6, 1932. Lake Yambo, near San Pablo, Laguna Province. *Spongilla fragilis* var. *decipiens* and a very tiny bit of *Ephydatia crateriformis*.

8. April 7 and 8, 1932. Lake Muekup, near San Pablo, Laguna Province. "Another of the crater lakes." *Spongilla fragilis* var. *decipiens*, *Ephydatia fortis* var. *vorstmani*, *Dosilia plumosa*, and *Trochospongilla latouchiana*.

9. May 12, 1932. Kamalibaguan, San Antonio, Zambales Province. "From a small swift river, with clear water." *Spongilla microsclerifera*.

The above record contains a total of six species, all already known from the Islands, collected from nine new localities.

SPONGILLA FRAGILIS var. DECIPIENS Weber.

Spongilla fragilis var. *decipiens* was found in eight of the nine localities, but was not collected in the ninth locality where the other *Spongilla*, *S. microsclerifera*, was taken.

This species is very variable, in a part of the specimens the gemmules form only small isolated patches closely attached to the support and arranged in a single layer. In some of the others, the gemmules continuously cover very much larger areas and are arranged in layers covering almost all of the supporting stems. Frequently the sponge forms a thicker cushion of growth than usual and the gemmules are arranged in a layer on the support and are also grouped together throughout the sponge body in twos, threes, or larger numbers in a manner very similar to the general grouping of the gemmules in the cosmopolitan form, *Spongilla fragilis*.

As a rule these sponges grow on the small dead branches of trees that have fallen into the water, and they vary in color from light yellowish brown to almost black. Their color seems to be dependent, to a certain degree at least, upon the amount of sediment in the water; some of the specimens contain the extremes of color on the same support, in which case they are evidently growths that have taken place at different times when the water bore a different quantity or type of sediment.

The Lake Pandin specimens have a large number of gemmule spicules with bulbous enlargements near the center.

The specimens from Lake Bunot are all small flat specimens taken from some flat support, probably stones, and in many cases the basal membranes are still intact. Most of these specimens are without gemmules, but a few of them have gemmules, bound together in groups as in *Spongilla fragilis*, scattered through the thin sponge. Had this sponge been found elsewhere and isolated from the other specimens it would probably have been called the type species rather than a variety, but the gemmule spicules are practically the same as those of the variety and one is inclined to call all the sponges by the same name. This very variable sponge seems to exhibit here in the Philippine Islands its transition from the type to the varietal form and raises the question as to whether the entire

lot of them are not, after all, *Spongilla fragilis* and should not be considered as variable forms of the type species. The layer of gemmules bound together as it is may be a necessary adaptation due to the thinness of the sponge, for when a thicker sponge body is present both arrangements of the gemmules may be found in the same specimen.

SPONGILLA MICROSCLERIFERA Annandale.

The small collection made from the small swift river with clear water at Kamalibaguan, San Antonio, consists of only one species, *Spongilla microsclerifera*, which was growing on branches of trees and forming continuous cushions, sometimes not more than a few millimeters thick, but at other times 1.5 centimeters thick.

The skeletal structure of the several specimens differs somewhat, sometimes in the thinner specimens it is made up of a meshwork without any distinct spicule fiber rays of any great length, but in the thicker specimens these perpendicular rays are clearly distinguishable and they are bound together by short, irregular, transverse but discontinuous rays.

When clean, the sponge is almost white; in some places it is covered with a green algal growth.

The gemmules grow in patches at the base of the sponge and are attached to the support. They seem to form small patches, at times almost a centimeter in length and irregular in shape. The gemmules are piled upon one another and are found four or five thick, but occur singly and have no characteristic grouping.

The gemmule spicules are very thickly spined in the portion around their ends, the spines are heavy and conical with sharp points, and often those perpendicular ones right near the ends of the spicules are recurved a bit at their tips. The spines near the middle of the spicule are smaller and fewer. The spicules are curved, rarely straight, and terminate in one or more finer spines; there may sometimes be several around the tip.

The flesh spicules are curved and very thin and are often even longer than the gemmule spicules. They are covered throughout their length with very fine spines, which are sometimes slightly larger in the middle of the spicule than at the end. In some of the spicules the longer spines may be divided or have other smaller spines on them near their ends.

This species was found in only one locality and it was the only sponge discovered there.

EPHYDATIA CRATERIFORMIS Potts.

Ephydatia crateriformis was represented in the collection by only a very minute scrap, which was accidentally found attached to the larger quantities of *Spongilla fragilis* var. *decipiens* collected in Lake Yambo, San Pablo. The specimen was a typical one in every way.

EPHYDATIA FORTIS var. **VORSTMANI** Gee.

Ephydatia fortis var. *vorstmani* was found in the following four localities: Morong, Rizal Province; Cardona, Laguna de Bay, Rizal Province; Lake Calibato, San Pablo, Laguna Province; and Lake Muekup, San Pablo, Laguna Province. These sponges are light in color and bear numerous gemmules. While there are variations in the size and the spininess of the skeleton spicules and similar variations in the birotulates, yet these specimens are all placed with this variety. This variety is quite a variable one.

TROCHOSPONGILLA LATOUCHIANA Annandale.

Trochospongilla latouchiana was found in only two places; namely, Lake Pandin and Lake Muekup, near San Pablo. In each case there were only three or four very small specimens growing on the tips of twigs with the whole of the rest of the twigs covered with the variety common in the collections, *Spongilla fragilis* var. *decipiens*. The sponge is very similar to those of this species already described from the Islands.

DOSILIA PLUMOSA Carter.

Dosilia plumosa was represented by one small characteristic specimen taken from Lake Muekup, one of the crater lakes near San Pablo. This lake is rich in sponges, producing four of the six forms represented in the whole collection.

NOTES ON ACANTHOCEPHALA IN THE PHILIPPINES

By MARCOS A. TUBANGUI

*Of the Division of Biology and Serum Laboratory
Bureau of Science, Manila*

SIX PLATES

INTRODUCTION

There have been recorded from the Philippines only two species of Acanthocephala; namely, the giant thorn-headed worm of swine, *Macracanthorhynchus hirudinaceus* (Pallas, 1781), by Schwartz (1925), and the beaded thorny-headed worm of rats, *Moniliformis moniliformis* (Bremser, 1811), by Tubangui (1931). In this paper are described six different species of these worms, one of which is from a fish and the rest from birds. Some years ago I collected from the small intestine of a native dog in Los Baños, Laguna, Luzon, a single specimen of what was believed to be a species of *Oncicola*. The material, however, cannot now be located, for which reason its description is not included here.

I wish to express my appreciation to Messrs. S. Garcia and A. Duyag, who collected most of the parasites to be described.

TECHNIC

The method advocated by Joyeux and Baer (1929) for collecting and preserving tapeworms was found satisfactory for fixing Acanthocephala in an extended condition and with the proboscis everted. After cleaning the body surface of the worms with a soft brush, they were placed in clean tap water, in which they were allowed to remain until they were dead or moribund. Then they were preserved in 5 per cent formalin solution. For microscopic study, the parasites were cleared and mounted at the same time in Gater's fluid by transferring them directly from the formalin solution to a slide containing a suitable amount of the liquid. The medium was evolved by Gater (1929) for mounting mosquito larvæ and has the following formula: Distilled water, 10 per cent; picked gum arabic, 8 per cent; chloral hydrate, 74 per cent; glucose syrup, 5 per cent; glacial acetic acid, 3 per cent. In a warm dry environment it

evaporates fairly quickly under a cover glass, and it is only necessary to run some more of the fluid under the cover glass with a pipette from time to time until air spaces are no longer formed. When completely dry, the slide may be put away as a permanent preparation.

Gater's medium has also been employed with equally satisfactory results in the rapid preparation of small to moderately large trematodes for examination under the microscope. In order to bring out the reproductive organs more conspicuously, the worms may either be stained with hydrochloric-acid-carmin solution before they are mounted or the medium may be tinted by the addition of a small amount of the stain before the unstained parasites are mounted in it. I have slides of echinostomes prepared in both ways in which the stain has remained unfaded for more than six months.

CLASSIFICATION

The Acanthocephala, or proboscis roundworms, together with the class Nematoda, or true roundworms, constitute the phylum Nemathelminthes. Yorke and Maplestone (1926) separate the members of the two classes as follows:

"Class I. Nematoda Rudolphi, 1808, emend. Diesing, 1861. *Nemathelminthes*; with a gut, but without proboscis.

"Class II. Acanthocephala Rudolphi, 1808. *Nemathelminthes*; without a gut, but with a proboscis usually protrusible and almost invariably furnished with hooks."

There is a general agreement among various authors in dividing the Acanthocephala into three groups, which, following the classification proposed by Southwell and Macfie (1925) as modified by Faust (1929), may be distinguished as follows:

1. Prostatic glands a single syncytial mass.... Order NEOECHINORHYNCHATA.
- Prostatic glands not a single syncytial mass..... 2.
2. Proboscis reduced, not capable of being withdrawn into the proboscis sheath Order GIGANTORHYNCHATA.
- Proboscis well developed and capable of being withdrawn into the proboscis sheath Order ECHINORHYNCHATA.

DESCRIPTIONS

Order NEOECHINORHYNCHATA

Family NEOECHINORHYNCHIDÆ Van Cleave, 1919

NEOECHINORHYNCHUS OCTONUCLEATUS sp. nov. Plate 1, figs. 1 and 2.

Material.—A single, nearly mature female from the small intestine of a fresh-water fish.

In the shape of the proboscis and in the number of its hooks, the specimen agrees with the members of the genus *Neoechinorhynchus* Stiles and Hassall, 1905. It differs from them, however, in the number of its subcuticular giant nuclei, of which there are six in the mid-dorsal line and two in the mid-ventral line. This difference is significant for, according to Van Cleave (1919), the members of *Neoechinorhynchus* and those of the other genera in the family Neoechinorhynchidae normally possess only five subcuticular nuclei in the mid-dorsal and one in the mid-ventral line. For this reason it will be necessary to modify the definition of the family and perhaps even to propose a distinct genus for the parasite in question.

Description.—Male unknown. Female 9.09 by 1.09 millimeters in size. Body cylindrical, anterior end a trifle broader than posterior end which tapers at first gradually, then abruptly, into a knoblike process. Cuticle smooth, thick; subcuticle with six giant nuclei in mid-dorsal line, two more in mid-ventral line.

Proboscis retracted and cannot be measured accurately; it appears short and globose; armed anteriorly with eighteen spines that are presumably arranged in three anteroposterior rows. Anterior row of hooks largest, 88 to 91 microns long, with distinct roots; rest of hooks smaller, those in last row only 35 to 38 microns long and without distinct roots.

Proboscis sheath with simple wall, 0.9 by 0.3 millimeter in size. Central nervous system not seen.

Lemnisci about twice as long as proboscis sheath, one with a single large nucleus and the other with two nuclei.

Body cavity filled with numerous roundish structures probably representing very immature ova. Genital pore ventral near posterior end of body.

Specific diagnosis.—*Neoechinorhynchus*: Female 9.09 by 1.09 millimeters in size. Subcuticle in mid-dorsal line with six and in mid-ventral line with two giant nuclei. Proboscis armed anteriorly with three circles of six hooks each; anterior row of hooks 88 to 91 microns long, those in last row 35 to 38 microns long. Proboscis sheath with simple wall, 0.9 by 0.3 millimeter in size. Lemnisci about twice as long as proboscis sheath.

Host.—Fresh-water fish, "ayuṅgin" (? *Therapon argenteus*).

Location.—Small intestine.

Locality.—Los Baños, Laguna, Luzon.

Type specimens.—Philippine Bureau of Science parasitological collection No. 112.

Order ECHINORHYNCHATA

Family ECHINORHYNCHIDÆ Cobbold, 1879

ECHINORHYNCHUS CENTROPUSI sp. nov. Plate 1, figs. 3 and 4; Plate 2, figs. 1 to 4.

Material.—Four males and five females all mature, from the small intestine of the red-winged coucal, *Centropus viridis*; also two apparently mature females supposed to have been collected from the rough-crested cuckoo, *Dasylophus superciliosus*. The latter host, however, must have been mistaken for a *Centropus*, for in an attempt to verify the origin of the second lot of material, we have examined several other cuckoos with negative results. On the other hand, the parasite seems common in the coucal.

Compared with *Echinorhynchus bulbocaudatus* Southwell and Macfie, 1925, a parasite of *Centropus phasianus* in Australia, the Philippine species is characterized by its smaller size and by the number and arrangement of the hooks on the proboscis.

Description.—Body elongate, cylindrical, with surface slightly rugose; anterior sixth or seventh of body length, especially in female, more or less enlarged and separated from rest of body by a circular constriction. Male measures 11.5 to 14.5 by 0.80 to 1 millimeters, female 20 to 30 by 0.90 to 1.25 millimeters.

Proboscis subspherical to ovate, 0.40 to 0.50 by 0.40 to 0.46 millimeter in size, armed with sixteen to eighteen circles of eight to ten hooks each. Hooks on anterior third of proboscis larger, each with rectangular root slightly hollowed posteriorly; they measure 87 to 102 microns long, including roots; rest of hooks smaller, 38 to 42 microns long, and with much-reduced roots.

Neck very short, unarmed.

Proboscis sheath double-walled, 1 to 1.20 by 0.30 to 0.38 millimeters in size, that of female only a trifle larger. Central nervous system behind middle of length of proboscis sheath.

Lemnisci narrow to moderately broad, each with single large nucleus, about twice as long as proboscis sheath, and reach posteriorly in male to anterior border of first testis.

Male: Testes oval to elongate, one immediately behind the other, sometimes slightly overlapping, 0.90 to 1.04 by 0.50 to 0.52 millimeters in size; they are located in anterior region of body, 0.30 to 1 millimeter from posterior end of proboscis sheath and immediately in front of circular constriction separating anterior sixth or seventh of body length from rest of body. Prostatic glands long, but their number could not be ascertained. Cement reservoir elongate, 2.40 by 0.30 millime-

ters in size. Bursa evaginated in two male specimens, bell-shaped, 1 to 1.12 by 0.85 to 0.94 millimeters in size.

Female: Posterior end slightly swollen before terminating in a conical tip. Uterine bell relatively small. Eggs in body cavity small, numerous, each with three concentric membranes, 29.0 to 37.5 by 14.5 to 18.7 microns in size.

Specific diagnosis.—*Echinorhynchus*: Male 11.5 to 14.5 by 0.80 to 1 millimeters in size, female 20 to 30 by 0.90 to 1.25 millimeters. Proboscis subspherical to ovate, 0.40 to 0.50 by 0.40 to 0.46 millimeter in size, armed with sixteen to eighteen circles of eight to ten hooks each; larger hooks 87 to 102 microns long, with rectangular roots; smaller hooks 38 to 42 microns long, with much-reduced roots. Proboscis sheath 1 to 1.20 by 0.30 to 0.38 millimeters in size. Central nervous system behind equator of proboscis sheath. Lemnisci about twice as long as proboscis sheath, reach posteriorly in male to anterior testis. Testes 0.90 to 1.04 by 0.50 to 0.52 millimeters in size. Eggs 29.0 to 37.5 by 14.5 to 18.7 microns in size.

Hosts.—*Centropus viridis* (type host) and *Dasylophus superciliosus* (?).

Location.—Small intestine.

Localities.—Novaliches, Rizal (type locality), and Los Baños, Laguna, Luzon.

Type specimens.—Philippine Bureau of Science parasitological collection No. 119.

PROSTHORHYNCHUS LIMNOBÆNI sp. nov. Plate 5, figs. 1 to 3.

Material.—Two apparently mature, poorly preserved males from the intestine of *Limnobænus fuscus*.

The specimens agree with the description of the genus *Prosthorhynchus* Kostylew, 1915, as given by Travassos (1926) in the following characters: The elongate, cylindrical, and ventrally inclined proboscis; the length of the lemnisci, which is only slightly more than that of the proboscis sheath; and the shape and position of the testes. Travassos does not describe the proboscis sheath, but according to Van Cleave (1923) it is double-walled. In the specimens in question it appears to possess a simple wall.

Description.—Female unknown. Male cylindrical, with smooth surface, 18 to 20 millimeters in length by 1.15 to 1.20 millimeters in maximum diameter; anterior end truncate, slightly bent; posterior end rounded, the bursa arising from its ventral aspect.

Proboscis elongate, cylindrical, measuring 1 to 1.06 by 0.18 to 0.20 millimeters and armed with numerous hooks arranged in forty-three alternating anteroposterior rows of eight hooks each. Hooks from one end of proboscis to the other almost uniform in size, with well-developed rectangular roots; lamina of hooks 50 to 54 microns, roots 45.6 to 48 microns long.

Neck absent.

Proboscis sheath elongate, slightly dilated posteriorly, with simple wall, 2.50 to 2.60 by 0.37 to 0.45 millimeters in size. Central nervous system between anterior and middle thirds of length of proboscis sheath.

Lemnisci narrow, slightly coiled, only a little longer than proboscis sheath.

Testes behind middle of body length, measure 0.86 to 1.35 by 0.48 to 0.54 millimeters. Details of prostatic glands could not be determined due to poor state of preservation of specimens. Cement reservoir elongate, 1.90 by 0.32 millimeters in size. Evaginated bursa measures 0.45 by 1 millimeter.

Specific diagnosis.—*Prosthorhynchus*: Female unknown. Male 18 to 20 by 1.15 to 1.20 millimeters in size. Proboscis 1 to 1.06 by 0.18 to 0.20 millimeters, armed with forty-three alternating anteroposterior rows of eight hooks each. Hooks almost uniform in size, with well-developed rectangular roots; lamina of hooks 50 to 54, roots 45.6 to 48 microns long. Neck absent. Proboscis sheath 2.50 to 2.60 by 0.37 to 0.45 millimeters; lemnisci only slightly longer than proboscis sheath. Testes behind middle of body length, 0.86 to 1.35 by 0.48 to 0.54 millimeters.

Host.—*Limnobæus fuscus*.

Location.—Intestine.

Locality.—Novaliches, Rizal, Luzon.

Type specimens.—Philippine Bureau of Science parasitological collection No. 122.

Family CENTRORHYNCHIDÆ Van Cleave, 1916

CENTRORHYNCHUS INSULARIS sp. nov. Plate 3, figs. 1 to 5.

Material.—Numerous mature males and females from the intestines of three different kinds of birds of prey.

Compared with the forms listed by Travassos (1926) in the genus *Centrorhynchus* Luehe, 1911, this species appears to resemble more closely *C. asturinus*, a parasite of several kinds of hawks in Australia. It seems to differ from the latter, as described by Johnston (1913) and by Southwell and Macfie, only in the number and arrangement of the hooks on the proboscis.

Description.—Body elongate, slightly curved, swollen anteriorly in both sexes; surface smooth.

Male smaller than female, 15 to 22 millimeters long, its swollen portion 1.3 to 1.8 millimeters in diameter and constituting about one-third of total body length; posterior region rounded distally, 0.6 to 1.1 millimeters across.

Proboscis ovoid, 0.60 to 0.64 by 0.32 to 0.34 millimeter in size, covered with numerous hooks arranged in thirty-two to thirty-four anteroposterior rows of sixteen to eighteen hooks each. Hooks with quadrangular roots and almost uniform in size; except those in last row, which are smaller and similar to those on neck; they measure 70 to 75 microns long, including roots.

Neck sharply delimited from proboscis by circular constriction, about as long as proboscis and armed with nineteen to twenty anteroposterior rows of hooks, each row with sixteen to twenty hooks. Hooks with very much reduced roots, 36 to 44 microns long.

Proboscis sheath double-walled, elongate, 1.60 to 1.70 by 0.37 to 0.43 millimeters in size. Ribbonlike retractor muscles attached at distal end of sheath; central nervous system near middle of its length. Retinacula long, narrow.

Lemnisci about twice as long as proboscis sheath, extending posteriorly to middle of distance between posterior end of proboscis sheath and anterior border of first testis; in contracted specimens, however, they may reach the anterior border of latter organ. Each seems to be provided with a prominent nucleus.

Testes oval to elongate, one very slightly obliquely behind the other and somewhat overlapping; they are located in middle of swollen anterior body region and measure 0.95 to 1.20 by 0.46 to 0.52 millimeters. Prostatic glands closely bunched together, 10 to 11.5 millimeters long; cement reservoir roomy, 1.80 to 2.50 by 0.43 to 0.65 millimeters in size; bursa in the retracted position 1.5 to 2 millimeters long.

Female 33 to 40 millimeters long, its swollen anterior region 1.60 to 2.25 millimeters in diameter and constituting one-fifth to one-fourth of total body length; posterior region of body 0.95 to 1.35 millimeters in diameter, produced distally behind genital pore into a short, blunt process. Proboscis 0.60 to 0.80 by 0.32 to 0.36 millimeter in size. Neck 0.40 to 0.50 millimeter long, separated from proboscis by constriction. Hooks on proboscis and neck of about the same size, number, and arrangement as those of male. Proboscis sheath 1.70 to 2.10 by 0.40 to 0.46 millimeters in size. Mature eggs numerous in body cavity, oval,

with three concentric membranes and a central nucleuslike mass; they measure 52.4 to 55 by 22.8 to 25 microns. (In one lot of specimens from *Spilornis bacha*, the mature eggs measure 45.7 to 50 by 22.8 to 25 microns.)

Specific diagnosis.—*Centrorhynchus*: Body elongate, slightly curved, with smooth surface, swollen anteriorly; male 15 to 22, female 33 to 40 millimeters long. Proboscis ovoid, 0.60 to 0.64 by 0.32 to 0.34 millimeter in male, 0.60 to 0.80 by 0.32 to 0.36 millimeter in female, armed with thirty-two to thirty-four anteroposterior rows of sixteen to eighteen hooks each. Neck separated from proboscis by circular constriction, about as long as or slightly shorter than proboscis, armed with nineteen to twenty anteroposterior rows of sixteen to twenty hooks each. Proboscis sheath 1.60 to 1.70 by 0.37 to 0.43 millimeters in size in male, 1.70 to 2.10 by 0.40 to 0.46 millimeters in female. Lemnisci about twice as long as proboscis sheath. Testes in middle of swollen body region of male, 0.95 to 1.20 by 0.46 to 0.52 millimeters in size. Mature eggs oval, with three concentric membranes, 45.7 to 55 by 22.8 to 25 microns in size.

Hosts.—*Haliastur intermedius* (type host), *Butastur indicus*, and *Spilornis bacha*.

Location.—Intestine.

Localities.—Iriga, Camarines Sur (type locality); Novaliches, Rizal, Luzon; and Palo, Leyte.

Type specimens.—Philippine Bureau of Science parasitological collection No. 113; paratypes Nos. 126 and 137.

EMPODIUS TURNIXENA sp. nov. Plate 4, figs. 1 to 4.

Material.—Three females from the intestine of *Turnix ocellata*.

The specimens are placed tentatively in the genus *Empodius* Travassos, 1916. Travassos (1924), who refers this genus to the family Gigantorhynchidæ, describes the hooks on the proboscis as being arranged into transverse and longitudinal series. This arrangement of the hooks was not observed in the specimens in question, but in other characters they tally with the description of the genus as given by Southwell and Macfie and included by them in the family Centrorhynchidæ.

Description.—Male unknown. Female elongate, cylindrical, more or less distinctly annulated superficially except at most anterior end; posterior extremity rounded, the cuticle sur-

rounding the genital pore being usually wrinkled or folded. Total length 12.5 to 17.5 millimeters, maximum diameter 0.62 to 0.70 millimeter. In opaque specimens the arrangement of the excretory vessels shows distinctly through the cuticle.

Proboscis somewhat conical, 0.34 to 0.38 by 0.22 to 0.26 (at base) millimeter in size, armed with thirteen to fourteen anteroposterior rows of eight to ten hooks each. Hooks bent, 55 to 65 microns long; they arise from indistinct papillalike, circular roots.

Neck as long as proboscis or shorter, 0.30 to 0.34 millimeter in maximum diameter, armed with about the same number of anteroposterior rows of hooks as the proboscis, each row containing twelve to fourteen hooks. Hooks on anterior half of neck larger, being one-third to one-half the size of those on proboscis; those on posterior half very minute.

Proboscis sheath double-walled, relatively small, measuring 0.50 to 0.65 by 0.20 to 0.24 millimeter. Central nervous system at equator of proboscis sheath or slightly posterior to that level.

Lemnisci much elongated but narrow, 3.80 to 4.05 millimeters long.

Body cavity filled with numerous immature eggs, 41.5 to 45.5 by 20.8 to 22.5 microns in size. Uterine bell measures 0.50 by 0.14 millimeter. Genital pore posteroterminal.

Specific diagnosis.—*Empodius*: Male unknown. Female 12.5 to 17.5 by 0.62 to 0.70 millimeters in size; body surface distinctly annulated. Proboscis 0.34 to 0.38 by 0.22 to 0.26 millimeter, armed with thirteen to fourteen anteroposterior rows of eight to ten hooks each, 55 to 65 microns long. Neck about as long as or shorter than proboscis and armed with about the same number of anteroposterior rows of hooks, each row with twelve to fourteen small hooks. Proboscis sheath 0.50 to 0.65 by 0.20 to 0.24 millimeter in size. Lemnisci narrow, 3.80 to 4.05 millimeters long. Eggs (immature) 41.5 to 45.5 by 20.8 to 22.5 microns in size.

Host.—*Turnix ocellata*.

Location.—Intestine.

Locality.—Novaliches, Rizal, Luzon.

Type specimens.—Philippine Bureau of Science parasitological collection No. 139.

Order GIGANTORHYNCHATA

Family GIGANTORHYNCHIDÆ Hamann, 1892

OLIGACANTHORHYNCHUS POMATOSTOMI (Johnston and Cleland, 1911). Plate 6, figs. 1 to 4.

Echinorhynchus pomatostomi JOHNSTON and CLELAND, 1911.

Material.—Numerous immature males and females found encysted in the subcutaneous tissues of the necks of two species of birds.

The specimens bear a very close resemblance to those described by Johnston and Cleland (1911) from the subcutaneous tissues of Australian birds, differing from them only in being slightly larger and in the greater length of their lemnisci. It should be borne in mind, however, that both the Philippine and Australian forms are in the immature stage, and it is possible that the differences noted are due to differences in age. In fact, according to Southwell and Macfie (1925), the length of the lemnisci even in mature worms may vary within wide limits.

It has been decided to refer the parasite to the genus *Oligacanthorhynchus* Travassos, 1915, because of the absence of a well-marked sexual dimorphism, the shape and armature of the proboscis, the shape and length of the lemnisci, the location and shape of the testes, and the shape, number, and arrangement of the prostatic glands.

Description.—The cysts, as described by Johnston and Cleland, have the appearance of grains of rice or small maggots.

Sexual dimorphism not marked. Total length of body of extended individuals 6 to 7.50 millimeters, maximum diameter 1.08 to 1.40 millimeters.

Proboscis subspherical, 0.50 to 0.56 millimeter across, armed with five to six (usually five) anteroposterior rows of eight hooks each. Hooks of first four rows larger, not unlike those of members of the tapeworm genus *Tænia* in appearance, measuring 170 to 185 microns long; last row of hooks smaller, with vestigial roots, and measure 80 to 90 microns long. Pointed extremity of hooks curved, sometimes provided with small inner barb.

Proboscis sheath cylindrical, with simple wall, 1.00 to 1.10 by 0.40 to 0.50 millimeters in size. Central nervous system at or slightly behind middle of length of proboscis sheath.

Lemnisci narrow, coiled, as long as or sometimes longer than body proper; they do not, however, extend to posterior end of body, but only to middle of its length or a little behind that level.

Male: Reproductive organs in posterior two-thirds of body length. Testes relatively small, oval, tandem, 0.40 to 0.48 by 0.20 to 0.24 millimeter in size, located in middle third of body length. Prostatic glands oval, four pairs, arranged end to end from second testis to cement reservoir; latter 0.56 to 0.80 by 0.24 to 0.28 millimeter in size. Bursa retracted in all specimens examined; measures 0.90 to 1.10 by 0.32 to 0.36 millimeters.

Female: In all of the many specimens examined the ovary has disappeared. Instead numerous roundish bodies, 80 to 200 microns in diameter, occur in the body cavity either singly or in groups of two or four; these are most probably young ova, the remnants of the ovary. Uterine bell apparently not yet fully developed. Genital pore on ventral surface, near posterior end of body.

Hosts.—*Hypotænidia philippensis* and *Excalfactoria lineata*.

Location.—Subcutaneous tissues of neck.

Locality.—Novaliches, Rizal, Luzon.

REFERENCES

- FAUST, E. C. Human Helminthology. Philadelphia, Lea and Febiger (1929) XII + 616 pp., 297 figs.
- GATER, B. A. R. An improved method of mounting mosquito larvae. Bull. Ent. Res. 19 (1929) 367-368.
- JOHNSTON, T. H. Cestoda and Acanthocephala. Rept. Austral. Inst. Trop. Med. 1911 (1913) 75-96.
- JOHNSTON, T. H., and J. BURTON CLELAND. Echinorhynchus pomatostomi (n. sp.), a subcutaneous parasite of Australian birds. Journ. Proc. Roy. Soc. New South Wales 45 (1911) 111-114.
- JOYEUX, CH., and J. G. BAER. Les cestodes rares de l'homme. Bull. Soc. Pathol. Exot. 22 (1929) 114-136.
- SCHWARTZ, B. Helminth parasites of hogs in the Philippine Islands. Philip. Journ. Sci. 27 (1925) 227-231.
- SOUTHWELL, T., and J. W. S. MACFIE. On a collection of Acanthocephala in the Liverpool School of Tropical Medicine. Ann. Trop. Med. Parasit. 19 (1925) 141-184.
- TRAVASSOS, L. Contribucões para o conhecimento da fauna helminthologica brasileira. XX. Revisão dos Acanthocephalos brasileiros. Parte II. Família Echinorhynchidae Hamann, 1892, sub-família Centrorhynchinae Travassos, 1919. Mem. Inst. Oswaldo Cruz 19 (1926) 31-125.

- TUBANGUI, M. A. Worm parasites of the brown rat (*Mus norvegicus*) in the Philippine Islands, with special reference to those forms that may be transmitted to human beings. *Philip. Journ. Sci.* 46 (1931) 537-591.
- VAN CLEAVE, H. J. Acanthocephala from the Illinois River, with descriptions of new species and a synopsis of the family Neoechinorhynchidae. *Illinois Nat. Hist. Survey Bull.* 13 (1919) 225-257.
- VAN CLEAVE, H. J. A key to genera of Acanthocephala. *Trans. Am. Microsc. Soc.* 42 (1923) 184-191.
- YORKE, W., and P. A. MAPLESTONE. The Nematode Parasites of Vertebrates. Philadelphia, P. Blakiston's Son and Co. (1926) xi + 536 pp., 307 figs.

ILLUSTRATIONS

[Abbreviations used: *b*, bursa; *cns*, central nervous system; *cr*, cement reservoir; *ev*, excretory vessels; *gn*, giant nucleus; *gp*, genital pore; *l*, lemniscus (i); *n*, neck; *o*, eggs; *pg*, prostatic glands; *pr*, proboscis; *prs*, proboscis sheath; *rt*, retinacula.]

PLATE 1

- FIG. 1. *Neoechinorhynchus octonucleatus* sp. nov.; entire worm, lateral view.
2. Proboscis hooks of *Neoechinorhynchus octonucleatus*; *a*, large anterior hook; *b*, small posterior hook.
3. *Echinorhynchus centropusi* sp. nov.; anterior end of female, ventral view.
4. *Echinorhynchus centropusi* sp. nov.; egg.

PLATE 2

ECHINORHYNCHUS CENTROPUSI SP. NOV.

- FIG. 1. Rows of proboscis hooks.
2. Anterior end of male, lateral view.
3. Posterior end of male, lateral view.
4. Posterior end of female, ventral view.

PLATE 3

CENTRORHYNCHUS INSULARIS SP. NOV.

- FIG. 1. Hooks; *a*, on neck; *b*, on proboscis.
2. Anterior end of male, ventral view.
3. Posterior end of male, ventral view.
4. Posterior end of female, lateral view.
5. Egg.

PLATE 4

EMPODIUS TURNIXENA SP. NOV.

- FIG. 1. Proboscis hooks.
2. Anterior end of female, lateral view.
3. Anterior end of female, lateral view, proboscis enlarged.
4. Posterior end of female, lateral view.

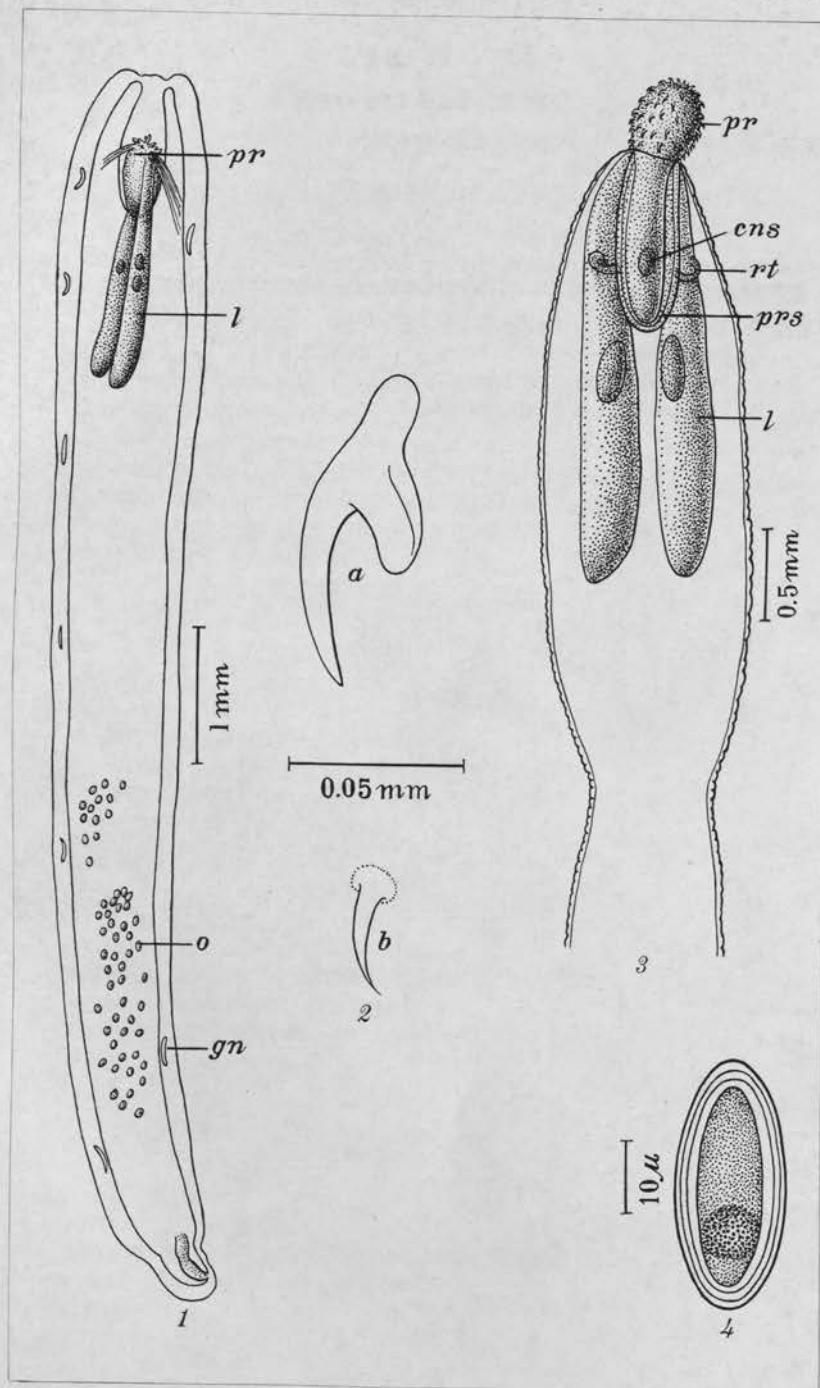


PLATE 1.

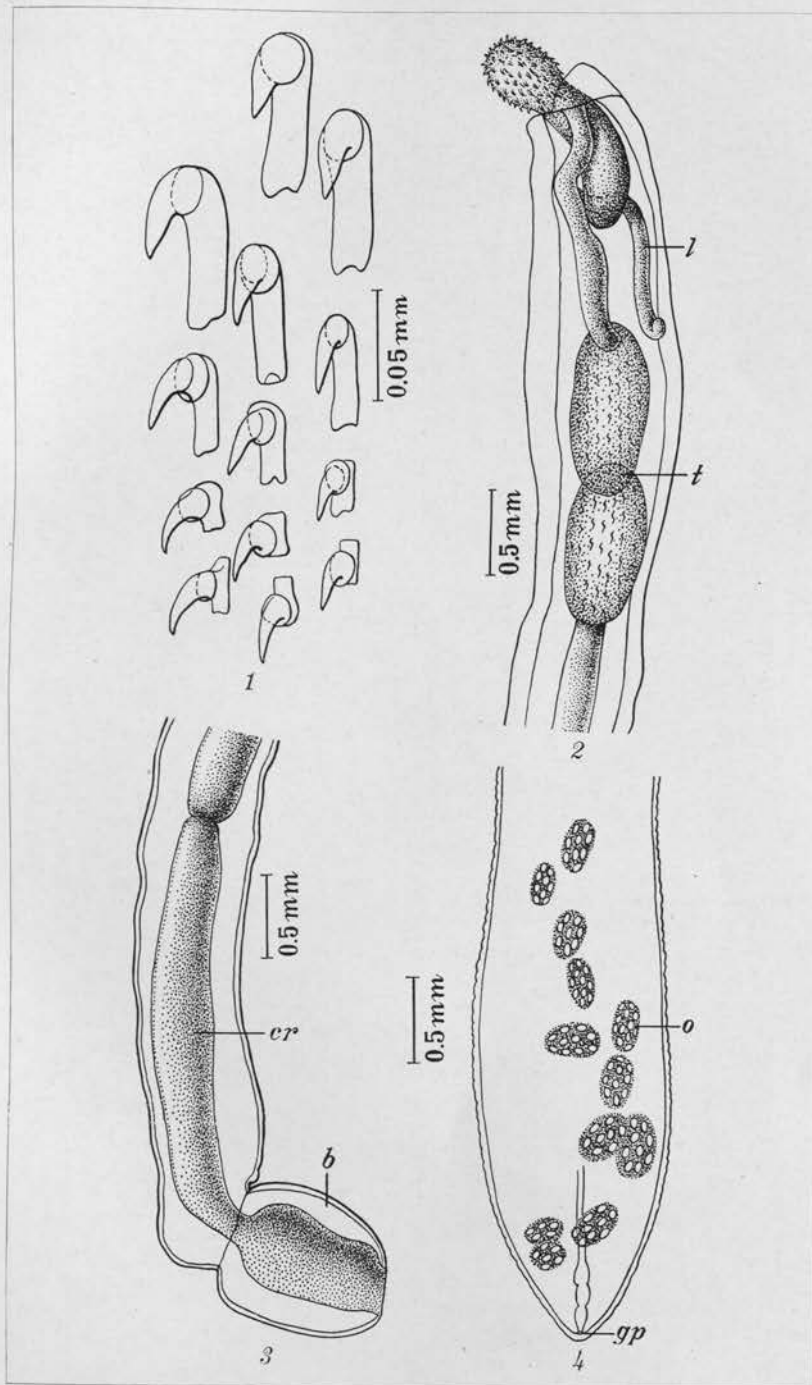


PLATE 2.

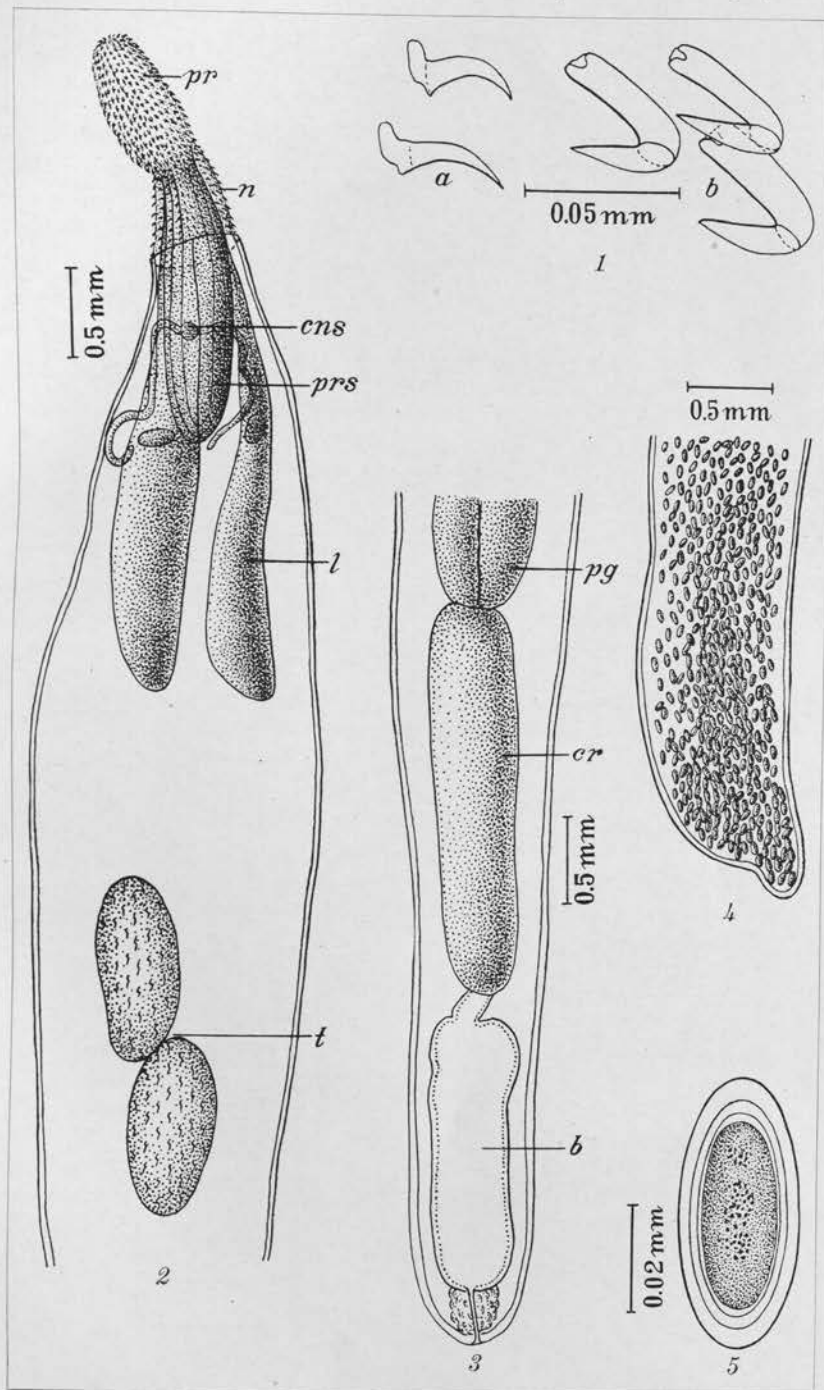


PLATE 3.

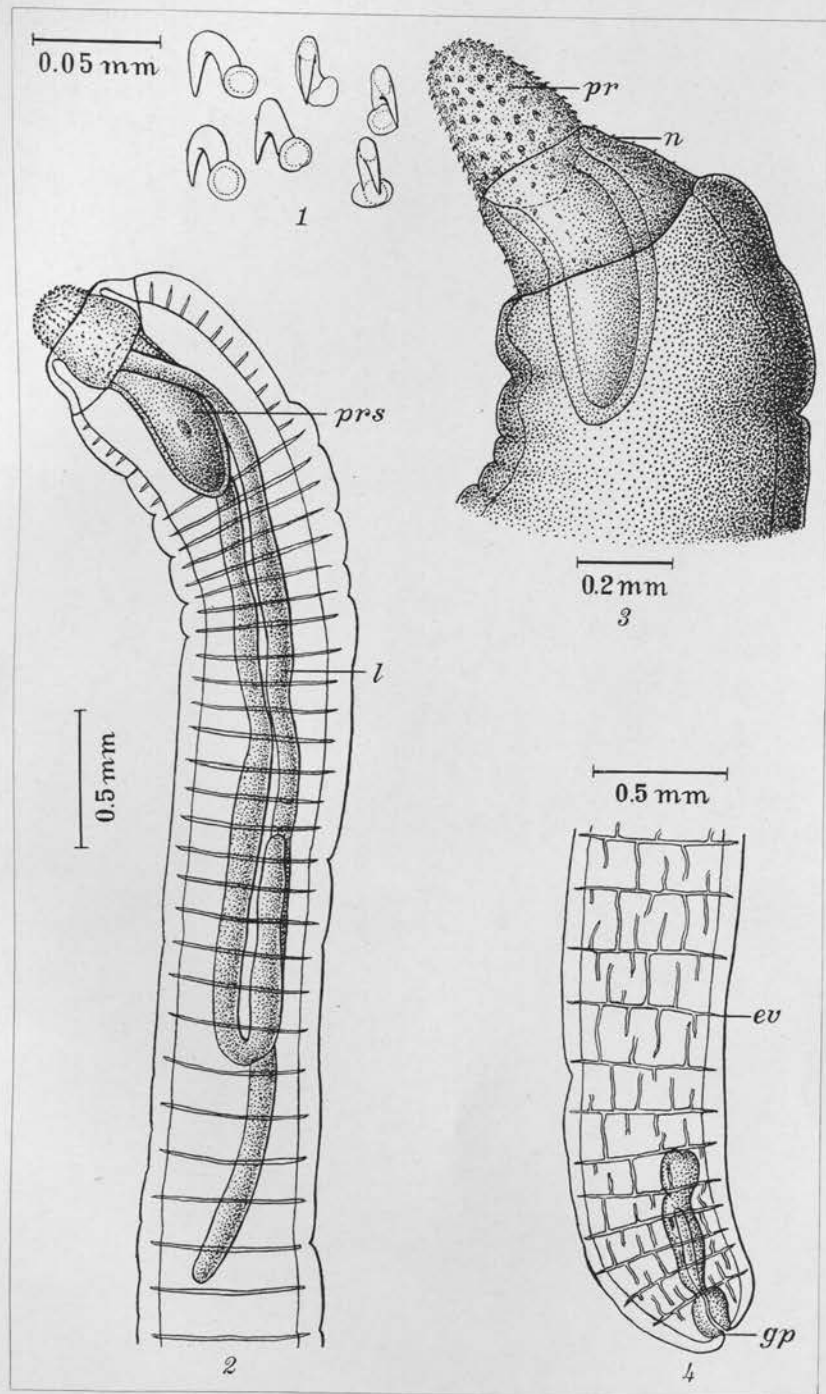


PLATE 4.

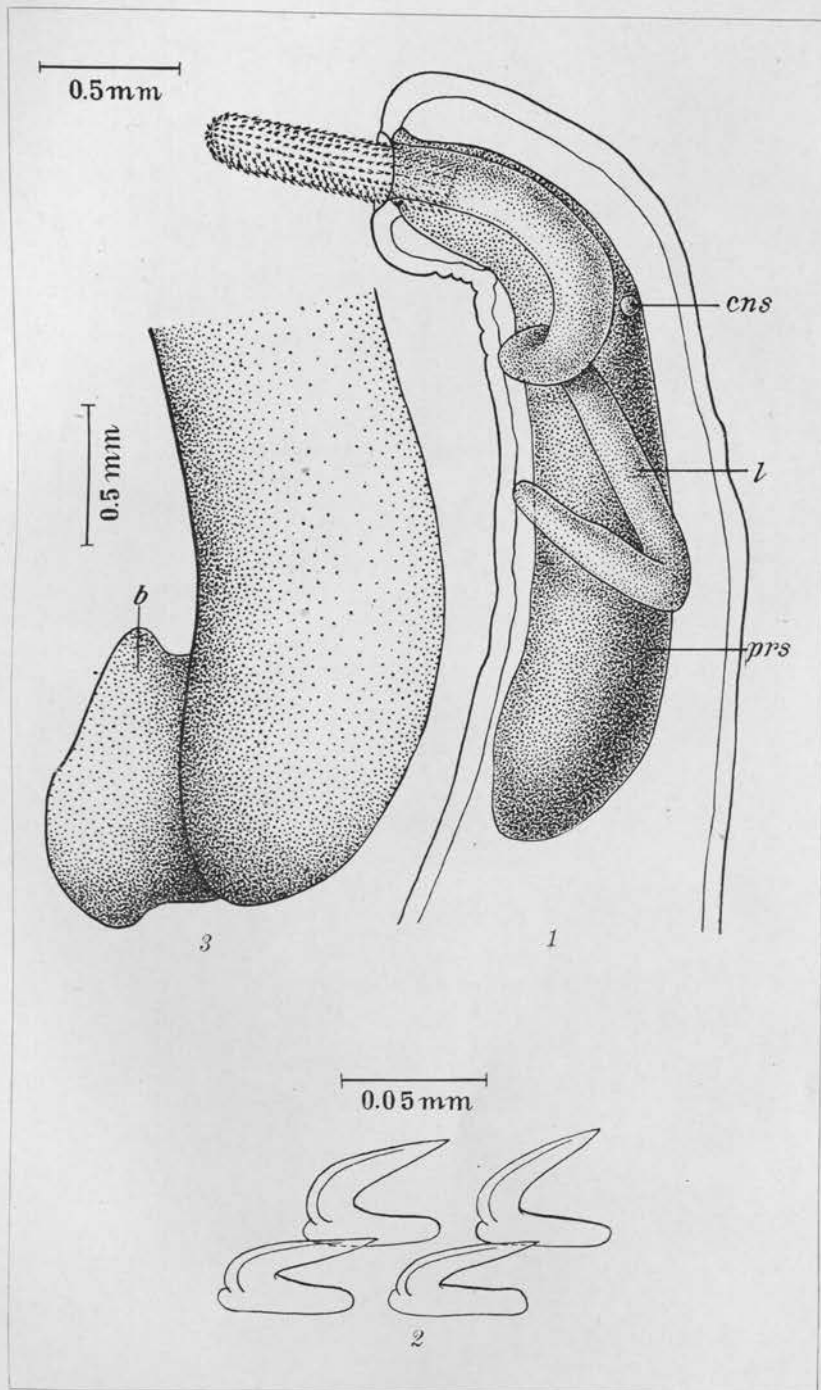


PLATE 5.

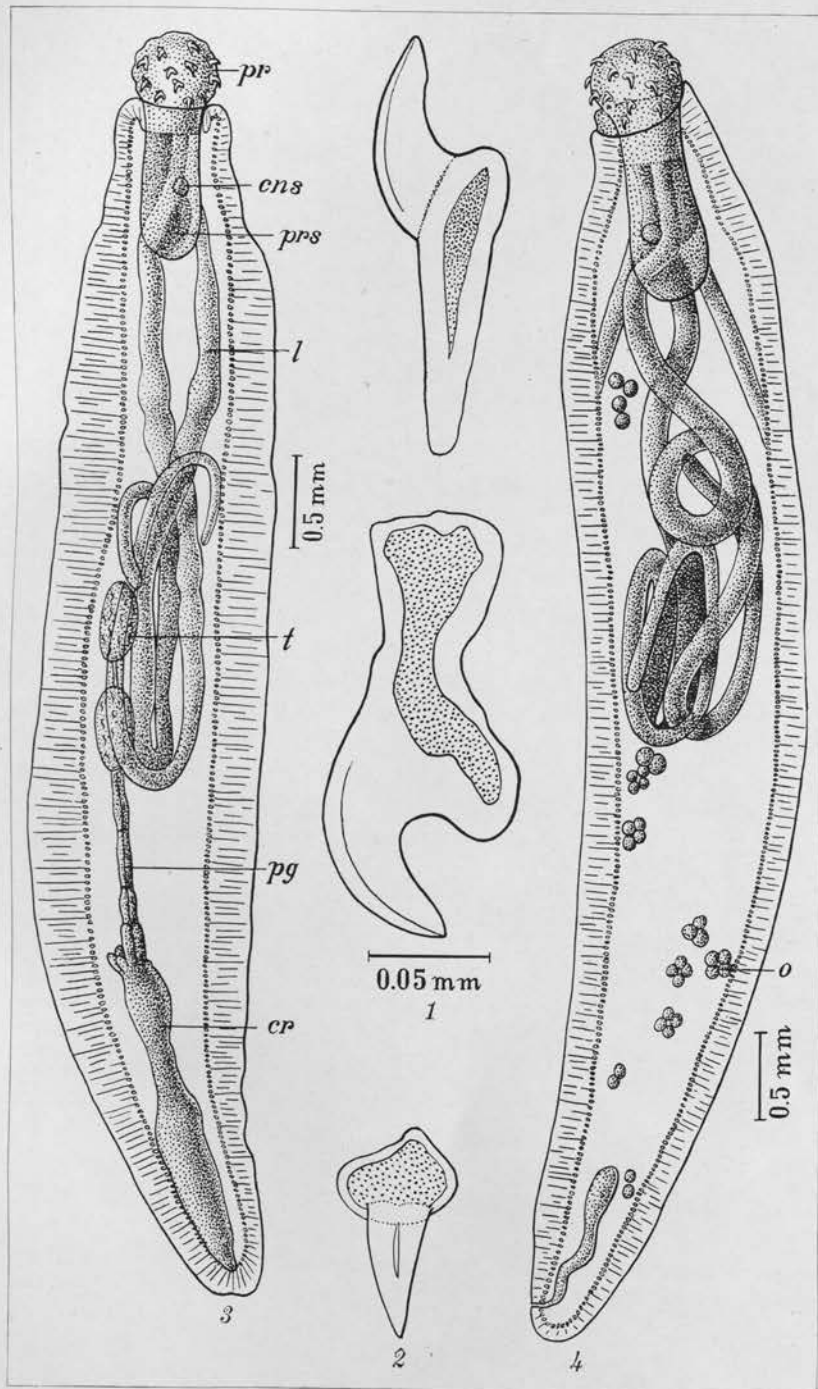


PLATE 6.

NEW OR LITTLE-KNOWN TIPULIDÆ FROM EASTERN ASIA (DIPTERA), XII¹

By CHARLES P. ALEXANDER

Of Amherst, Massachusetts

THREE PLATES

The crane flies discussed in the present report are chiefly from the mountains of western China, where they were taken by the Reverend Mr. Franck. A few additional records are based on the very extensive collections of Tipulidæ taken on the border between China and Tibet by the Reverend David C. Graham. The Japanese Tipulidæ discussed herewith were included in extensive series of these flies taken in the Japanese Alps by Dr. Jiro Machida, and in smaller collections made by Dr. Masaaki Tokunaga and by Mr. H. Yokouchi, the latter received through the kindly interest of Prof. Teiso Esaki. I am very greatly indebted to all of the entomologists above mentioned for this continued coöperation in making known the vast crane fly fauna of the mountains of eastern Asia. Except where noted to the contrary, the types of all novelties in this paper are preserved in the collection of the writer.

TRICHOCERIDÆ

I am including this family in the present series of papers on the eastern Asian crane flies.

TRICHOCERA RETICULATA sp. nov. Plate I, fig. 1.

Belongs to the *maculipennis* group; general coloration dark; knobs of halteres blackened; femora yellowish brown, with a narrow black subterminal ring, the tips narrowly light yellow; wings yellow, with a heavy reticulate brown pattern.

Female.—Length, about 7.5 millimeters; wing, 7.8.

Rostrum and palpi black. Antennæ black throughout. Head blackish.

Mesonotum chiefly dark-colored, the præscutum with a yellowish pollen that leaves brown stripes on the disk. Pleura dark

¹ Contribution from the entomological laboratory, Massachusetts State College.

gray, variegated by blackish areas. Halteres pale yellow, the knobs blackened. Legs with the coxæ dark-colored, pruinose, the fore coxæ more yellowish beneath; femora yellowish brown, with a narrow black subterminal ring, the extreme tips light yellow; tibiae brown, the bases and tips slightly darker; tarsi dark brown. Wings (Plate 1, fig. 1) light yellow, with a heavy, reticulate, dark brown pattern, including larger areas at origin of Rs, anterior cord and in outer radial field about opposite the end of vein R_{1+2} ; narrow, transverse, brown lines in all cells of wing excepting the small 1st M_2 and 2d A; in cell C about fourteen such areas, in cell M about nine, in cell Cu about twelve; in the outer radial field the areas narrower and more widely separated; in cell 1st A the individual areas are irregularly doubled; veins obscure yellow, darker in the infuscated areas. Venation: Cell 2d A relatively wide.

Abdomen black, the caudal margins of the segments narrowly paler.

Habitat.—China (Szechwan).

Holotype, female, Mount Omei, altitude 11,000 feet, July 18, 1931 (*Franck*).

Trichocera reticulata is most nearly allied to the Oriental *T. ocellata* Walker and *T. punctipennis* Brunetti, differing from these and all other known members of the family in the closely reticulated, dark brown pattern of the light yellow wings, with no indication of the areas being arranged to form ocelliform patterns.

TIPULIDÆ

TIPULINÆ

TIPULINI

TIPULA NIGROBASALIS sp. nov.

Large (wing, female, over 25 millimeters); antennæ bicolorous; mesonotal præscutum with the ground color golden yellow, with four brown stripes that are narrowly bordered by slightly darker brown, the stripes confluent or nearly so; scutellum velvety black; postnotal mediotergite and central portion of pleura light golden yellow; propleura, dorsopleural region, and pleurotergite dark brown; halteres blackened; legs long, yellow, the femoral tips narrowly blackened; wings brownish yellow, the prearcular region conspicuously blackened; abdominal tergites reddish brown, the lateral margins darker brown.

Female.—Length, about 33 millimeters; wing, 27.5.

Frontal prolongation of head relatively long, brown, darker laterally; nasus unusually long and powerful; palpi black. Antennæ with the elongate scape dark brown; pedicel obscure yellow; flagellar segments bicolorous, yellow, with the basal enlargements dark brown; verticils exceeding the segments. Head brown, the posterior orbits narrowly obscure yellow; region of anterior vertex more velvety dark brown; front grayish brown; anterior vertex relatively narrow, about twice the greatest diameter of scape.

Pronotum dark brown, sparsely gray pruinose. Mesonotal præscutum golden yellow laterally, with four brown stripes that are nearly confluent, the anterior portion of interspaces being infuscated; stripes very vaguely bordered by a slightly darker brown margin, the intermediate pair being divided only by this capillary darkened vitta; scutum similarly dark brown, the median region not paler; scutellum velvety black, the parascutella obscure yellow; postnotal mediotergite light golden yellow. Pleura chiefly light golden yellow, this color occupying the anepisternum, dorsal sternopleurite, pteropleurite, and meron; dorsopleural region and propleura conspicuously blackened; ventral sternopleurite dark gray; pleurotergite dark brown. Halteres blackened. Legs elongate; coxæ dark brown, the mid-coxæ more yellow dusted; trochanters brownish black; femora yellow, the tips narrowly but conspicuously blackened; tibiæ obscure yellow, the tips narrowly and weakly infuscated; tarsi elongate, obscure yellow, the terminal segments blackened; spur formula 1-?-2, the mid-legs and all claws being broken. Wings with a strong brownish yellow suffusion, the prearcular region abruptly blackened; cell C and stigmal region weakly infumed; vague dusky seams near outer end of cell M and at two-fifths the length of cell Cu; a dusky seam along anterior cord, interspersed with conspicuous oblitative areas before stigma and along cord; clearer yellow areas in the bases of cells Cu, 1st A and 2d A, and before the dusky spot in cell M; veins deep yellow. Macrotrichia of veins small but abundant, including almost the entire extent of both anal veins; squama with small setæ. Venation: Rs a trifle longer than m-cu; R_{1+2} entire; m-cu at fork of M_{3+4} .

Abdominal tergites reddish brown, the lateral margins darker brown; sternites brown, the basal rings darker, the caudal margins somewhat more fulvous. Ovipositor with the cerci smooth and slender, nearly straight.

Habitat.—China (Szechwan).

Holotype, female, Mount Omei, altitude 7,000 feet, July 17, 1931 (Franck).

This very striking *Tipula* requires comparison with no described member of the genus. The general coloration of the wings is somewhat as in *T. moiwana* (Matsumura), *T. ultima* Alexander, and other similar species, but the highly contrasting wing bases and the striking thoracic pattern are clearly different.

TIPULA MACHIDAI sp. nov. Plate 1, fig. 2; Plate 2, figs. 25 to 28.

General coloration gray, the præscutum with four conspicuous dark brown stripes; nasus lacking; antennal flagellum black; tibiæ and tarsi black; wings yellowish, the stigma dark brown, the apex narrowly darkened; R_{1+2} entire; basal abdominal tergite gray; segments two and three yellow, the tergites trivittate with black, the remaining segments blackened; male hypopygium with the tergite broadly emarginate caudally, the median area produced into a deflexed plate.

Male.—Length, about 15 millimeters; wing, 18.5.

Frontal prolongation of head gray, without nasus; palpi black. Antennæ with the scape and pedicel light yellow; flagellum black throughout; basal enlargements of segments small; verticils elongate, subequal in length to the basal segments, longer than the outer ones. Head gray, the center of vertex infuscated; no vertical tubercle.

Mesonotal præscutum gray, with four conspicuous dark brown stripes, the intermediate pair separated by a capillary gray line; pseudosutural foveæ lacking; scutum gray, the centers of lobes dark brown; scutellum dark gray, with a capillary vitta on basal portion; postnotum dark gray. Pleura light gray. Halteres yellow, the knobs dark brown. Legs with the coxæ gray; trochanters yellow; femora brownish yellow, clearer yellow basally, the tips broadly blackened, most extensively so on the fore femora; remainder of legs black; tibial spur formula 1-2-2; claws small, simple. Wings (Plate 1, fig. 2) with the ground color yellowish, the prearcular and costal regions deeper yellow; stigma oval, dark brown; wing apex narrowly but conspicuously darkened; very narrow dark seams along cord; distal half of vein 2d A seamed with brown; veins dark brown, Sc, R_1 , and R_{1+2} more yellowish. No macrotrichia on squama, those of veins small and scanty. Venation: Rs long, about twice m-cu; R_{1+2} entire, sinuous; cell 1st M_2 elongate, about equal in length to cell M_1 ; distal section of M_3 strongly sinuous.

Abdomen with basal tergite light gray; segments two and three yellow, the tergites trivittate with black; on outer segments, including hypopygium, uniformly blackened. Male hypopygium (Plate 2, fig. 25) with the tergite, 9*t*, entirely distinct from the sternite, 9*s*; basistyle, *b*, entirely fused with sternite. Ninth tergite (Plate 2, fig. 26, 9*t*) transverse, the lateral angles produced, the median area extended into a deflexed plate that is invisible from above; caudal half of tergite with very abundant small setæ. Ninth sternite (Plate 2, fig. 27, 9*s*,) with the median area entirely but narrowly membranous; eighth sternite, 8*s*, unarmed, its margin transverse. Outer dististyle (Plate 2, fig. 28, *od*) a pale, flattened lobe, its length about two and one-half times its greatest width. Inner dististyle (Plate 2, fig. 28, *id*) simple, relatively long and narrow, the distal third blackened, the "heel" portion produced into a small spine.

Habitat.—Japan (Honshiu).

Holotype, male, Mitake, Musashi, April 26, 1931 (*J. Machida*).

I take great pleasure in naming this crane fly in honor of my old friend Dr. Jiro Machida. A careful study of the approximately one hundred Japanese species of *Tipula* known to me has failed to show a single one with which the present fly can be compared profitably. *Tipula nippostalpina* Alexander likewise lacks the nasus but is in all other respects a very different fly. In its general appearance, the present form bears a superficial resemblance to *T. dichroistigma* Alexander, but the relationship between the two seems remote. Likewise, I cannot satisfactorily place this fly in any of the subgenera of *Tipula* as defined by Edwards.²

TIPULA (FORMOTIPULA) LUTEICORPORIS sp. nov. Plate 1, fig. 3; Plate 2, figs. 29 to 31.

Thorax and abdomen orange-yellow; head black; antennæ black, the pedicel light yellow; knobs of halteres dark brown; legs black, the femoral bases obscure yellow; wings dusky, R_{1+2} preserved; male hypopygium with a single dististyle; eighth sternite broad, each caudolateral angle produced into a small setiferous lobule.

Male.—Length, about 10 millimeters; wing, 11.8.

Frontal prolongation of head black; nasus distinct, black, slightly deflexed; palpi black. Antennæ 12-segmented, black, with the exception of the light yellow pedicel; basal enlargements of flagellar segments small; terminal segment subequal

² Ann. & Mag. Nat. Hist. X 8 (1931) 73–82.

in length to penultimate, but with outer half strongly narrowed; longest verticils about equal to the segments. Head black; vertical tubercle scarcely developed.

Mesothorax entirely light orange-yellow. Halteres pale yellow, the knobs dark brown. Legs with the coxæ and trochanters orange; femora obscure yellow basally, the distal third passing into black; tibiæ and tarsi black, the latter elongate. Wings (Plate 1, fig. 3) with a strong dusky tinge; stigma oval, dark brown; veins black; obliterative areas at distal third of Rs, all of basal section of M_{1+2} , basal third of second section of M_{1+2} , and virtually all of basal section of M_3 . Venation: R_{1+2} entirely preserved and provided with about ten macrotrichia.

Abdomen, including hypopygium, entirely orange-yellow. Male hypopygium (Plate 2, fig. 29) with the tergite, 9t, entirely separate from the sternite, 9s; basistyle, b, with about the central third fused with the sternite, the dorsal suture shorter than the ventral. Ninth tergite (Plate 2, fig. 30, 9t) narrowly transverse; viewed from above with an acute blackened point on either side of midline; viewed laterally, each of these blackened points is seen to be very high and with the profile irregularly toothed. Eighth sternite (Plate 2, fig. 31, 8s) broad, forming a sheath, each caudolateral angle produced into a small lobe that bears long setæ; caudal margin between these lobes truncate or nearly so. Apparently a single dististyle (Plate 2, fig. 29, d), the apical beak very slender, acute.

Habitat.—China (Szechwan).

Holotype, male, Mount Omei, altitude 4,000 feet, August 14, 1931 (Franck).

Tipula (*Formotipula*) *luteicorporis* is readily told from all other described species of the subgenus by the uniform orange-yellow coloration of the thorax and abdomen, in conjunction with the persistence of vein R_{1+2} . *Tipula* (F.) *exusta* Alexander (western China) has a somewhat similar coloration but with vein R_{1+2} atrophied and with a distinctly different male hypopygium.

LIMONIINÆ

LIMONIINI

LIMONIA (LIMONIA) LACKSCHEWITZIANA sp. nov. Plate 1, fig. 4; Plate 2, fig. 32.

Belongs to the *tripunctata* group; general coloration yellow, the pronotum, præscutum, and postnotal mediotergite with an intense black median vitta, the scutum and scutellum with a common V-shaped black pattern, the point at the caudal margin

of scutellum; knobs of halteres infuscated; femora and tibiæ yellow, narrowly tipped with black; wings light yellow, almost immaculate, the stigmal area restricted; abdomen yellow, the tergites with a median black stripe; caudal margins of basal sternites narrowly blackened; male hypopygium with the dististyle bidentate at apex; gonapophyses with delicate setulæ over most of surface.

Male.—Length, about 7 to 7.5 millimeters; wing, 8.5 to 9.

Female.—Length, about 8 to 8.5 millimeters; wing, 9 to 9.5.

Rostrum brownish yellow; palpi black. Antennæ with the scape, pedicel, and basal two or three flagellar segments yellow, the outer segments passing into dark brown; flagellar segments elongate-oval, the verticils exceeding the segments. Head yellow, the central portion of vertex more infuscated.

Pronotum yellow, with a black median line. Mesonotal præscutum yellow with a single median vitta, intensely black and very clearly defined, widest in front, more narrowed behind, ending at the suture; scutum and scutellum yellow, with two black areas that begin at the suture, converging behind, meeting to form a V at the posterior margin of scutellum; postnotal mediotergite yellow laterally, broadly blackened medially. Pleura and pleurotergite yellow. Halteres with the stem yellow, the knobs infuscated. Legs with the coxæ and trochanters yellow; femora yellow, the tips narrowly but conspicuously black, the amount subequal on all legs; tibiæ yellow, the tips narrowly blackened; tarsi black. Wings (Plate 1, fig. 4) light yellow, more saturated on cephalic third, almost unmarked; stigmal darkening evidenced only by narrow seams to free tip of Sc_2 and R_2 ; veins dark brown. Venation: Sc_1 ending about opposite midlength of R_s , Sc_2 longer; free tip of Sc_2 longer than R_2 , in cases as much as one-half longer; m-cu variable in position, from before to shortly beyond the fork of M.

Abdominal tergites yellow, with a very distinct black median vitta that tends to widen out at the caudal margins of the individual segments, forming triangular or \perp -shaped markings; hypopygium chiefly blackened; sternites yellow, the caudal margins of the basal segments narrowly blackened. Male hypopygium (Plate 2, fig. 32) with the tergite, $9t$, large, narrowed outwardly, the nearly truncate apex about as wide as the length of the sclerite. A single dististyle, d , the apex bidentate, the outer face at base protuberant and with abundant erect setæ. Gonapophyses, g , with the mesal-apical angle long and slender, the surface of apophysis covered with microscopic setulæ almost

to apex of spine. *Ædeagus* very large, with a subapical marginal lobe.

Habitat.—Western China to Tibet.

Holotype, male, Mount Omei, Szechwan, China, altitude 9,000 feet, July 29, 1931 (*Franck*). Allotopotype, female. Paratopotypes, 6 males and females, July 20 to 29, 1931. Paratypes, 1 female, Mount Omei, altitude 8,500 feet, July 29, 1931; 1 male, Tang-Gu, China-Tibet border, altitude 14,000 feet, August 3 to 6, 1930 (*Graham*), in United States National Museum.

I take great pleasure in naming this interesting high-altitude *Limonia* in honor of Dr. P. Lackschewitz, distinguished authority on the Tipulidæ of the Palæarctic Region. The species is closest to western palæarctic forms such as *stigma* (Meigen) and *tripunctata* (Fabricius). By Lackschewitz's key to the European species of *Limonia sensu strictu*³ it runs to *stigma*, differing especially in the details of the coloration of the thorax and wings and in the structure of the male hypopygium. There appears to be no closely allied form among the described Himalayan and Japanese species.

LIMONIA (LIMONIA) COMMIXTA sp. nov. Plate 1, fig. 5; Plate 2, fig. 33.

Belongs to the *pendleburyi* group; general coloration uniform ocher-yellow, the dorsal pleural region infuscated; eyes confluent above; legs yellow, the femoral tips weakly infuscated; wings with a yellow tinge, the subcircular stigma dark brown; Sc_1 ending beyond the fork of Rs , Sc_2 at its tip; m-cu beyond fork of M ; abdomen bicolorous, the bases of the individual segments pale; male hypopygium with a complex development of the ventromesal lobe of basistyle.

Male.—Length, about 5.4 millimeters; wing, 6.2.

Rostrum brown, of moderate length; palpi with the basal two segments infuscated, the terminal two segments somewhat paler. Antennæ dark brown throughout; flagellar segments oval, the verticils exceeding the segments. Head dark gray; eyes confluent on anterior vertex.

Pronotum dark brown. Mesonotum almost uniformly ocher-yellow, without distinct markings, the postnotum darker. Pleura with the dorsal portion extensively infuscated, the ventral pleurites narrowly yellow. Halteres weakly infuscated. Legs with the coxæ obscure yellow, the fore coxæ more infuscated; trochanters yellow; femora yellow, the tips weakly infuscated; tibiæ and tarsi obscure yellow. Wings (Plate 1, fig. 5) with

³ Ann. Naturhist. Mus. Wien 42 (1928) 233–234.

a yellowish tinge, the costal region somewhat clearer yellow; stigma subcircular, dark brown; veins pale brown, more yellowish in the flavous areas. Venation: Sc of unusual length for a member of this subgenus, Sc₁ ending beyond the fork of Rs, Sc₂ at its tip; Rs in oblique alignment with basal section of R₄₊₅, nearly three times the length of the latter vein; free tip of Sc₂ and R₂ in transverse alignment; cell 1st M₂ elongate, subequal to vein M₁₊₂ beyond it; m-cu more than one-fourth its length beyond the fork of M; anal veins slightly convergent at bases.

Abdomen bicolorous, the bases of the individual segments obscure yellow, the apices brownish black, the amount of the latter including more than one-half the segment on the tergites, much narrower on the sternites; hypopygium obscure yellow. Male hypopygium (Plate 2, fig. 33) with the caudal margin of the large tergite, 9t, transversely rounded. Basistyle, b, with the ventromesal lobe very large, fully as long as the style itself, complex in structure, the outer margin being notched and bearing two slender lobes, mb, that are of unequal stoutness, both bearing elongate setæ at tips. A single complex dististyle, d. Gonapophyses, g, usually broad, the mesal-apical beak slender, the surface with delicate parallel striæ, as in the group.

Habitat.—China (Szechwan).

Holotype, male, Mount Omei, altitude 4,000 feet, August 3, 1931 (Franck).

Limonia (*Limonia*) *commixta* is allied to species such as *L.* (*L.*) *pendleburyi* Edwards (Pahang), differing most evidently in the more *Libnotes*-like venation, as the straight Rs and position of m-cu, together with the structure of the male hypopygium, which is quite different from the other described members of the group. The venation as found within the limits of this single restricted aggregation of species in eastern Asia closely connects the two types of venation held as typical of the subgenera *Limonia* and *Libnotes*.

LIMONIA (DICRANOMYIA) SHINANOENSIS sp. nov. Plate 1, fig. 6.

General coloration brownish black (probably pruinose in dry specimens); antennal scape and pedicel black, the flagellar segments bicolorous, their bases yellow, the apices pale brown; legs yellow, the tips of femora narrowly but conspicuously blackened; tibiæ uniformly obscure yellow; wings whitened, with a heavy brown pattern that is chiefly costal in distribution, the dark areas approximately as wide as the interspaces.

Female.—Length, about 8.5 millimeters; wings, 7.2.

Described from an alcoholic specimen.

Rostrum and palpi brownish black. Antennæ with the scape and pedicel black, the flagellum abruptly brownish yellow, somewhat bicolorous, the basal half of each segment more yellow than the apex; flagellar segments oval, the verticils shorter than the segments; terminal segment about one-third longer than the penultimate, narrowed apically. Head blackish; anterior vertex narrow.

General coloration of thorax brownish black, the præscutum apparently darker medially; pleura variegated with paler on pteropleurite and dorsal sternopleurite; thorax probably heavily pruinose in fresh specimens. Halteres pale, the knobs blackened. Legs with the coxæ blackened, narrowly paler at tips; trochanters obscure yellow; femora yellow, the tips narrowly but conspicuously blackened; tibiæ obscure yellow throughout; tarsi obscure yellow, the terminal three segments blackened; claws with a conspicuous subbasal spine, with an additional series of about three more basal teeth, these being progressively larger outwardly. Wings (Plate 1, fig. 6) whitish, including the prearcular region; a heavy dark brown pattern, chiefly costal and apical in distribution; four major costal areas before the more extensively darkened apex, the fourth area being the stigmal; these areas solidly darkened in the costal and subcostal cells, their centers paling to grayish in the radial field; subquadrate in outline, not strongly narrowed in the radial field (as in *frivola* and *shirakii*), a very little more extensive than the pale interspaces; additional dark areas include a large spot at fork of Rs, confluent with the stigma; a smaller area on r-m; cord and outer end of cell 1st M₂ seamed with brown; large, paler brown areas at ends of veins Cu, 1st A, and 2d A; dusky washes covering most of cell M and crossing the basal portions of cells Cu, 1st A, and 2d A to the axillary margin; veins dark, paler in the whitened areas. Venation: Sc₁ ending shortly beyond origin of Rs; Sc₂ (or a supernumerary crossvein) far from tip of Sc₁, at near midlength of Sc; m-cu close to fork of M.

Abdomen dark brown, the caudal margins of the segments narrowly but conspicuously ringed with pale; ovipositor with the shields pale yellow, the valves darker. Cerci slender and nearly straight.

Habitat.—Japan (Honshiu).

Holotype, alcoholic female, Kumanoyu, Shinano, July 6, 1931 (*H. Yokouchi*). Type in collection of Kyushu Imperial University.

I consider it somewhat doubtful that *Limonia* (*Dicranomyia*) *shinanoensis* belongs to the *pulchripennis* group, all other known members of which have the bases and apices of the tibiae conspicuously darkened. The present fly has a wing pattern that is most like that of *L. (D.) kirishimana* Alexander (Japan), differing most evidently in the much broader costal interspaces, which are here nearly as extensive as the dark areas; in *kirishimana* the pale areas in cell C are scarcely one-third to one-fourth as extensive as the dark markings.

LIMONIA (DICRANOMYIA) TRISPINULA sp. nov. Plate 1, fig. 7; Plate 2, fig. 34.

General coloration light yellow; femora with more than distal half brownish black; tibiae brownish black; wings with a faint brownish tinge, the oval stigma dark brown; Sc_1 subequal in length to Rs; m-cu more than one-third its length before the fork of M; male hypopygium with the rostral prolongation of the ventral dististyle trispinous.

Male.—Length, about 4.5 millimeters; wing, 5.

Most of head destroyed; posterior vertex extensively yellowish, sparsely pruinose.

Mesonotum and pleura uniformly pale yellow. Halteres pale, the knobs weakly infuscated. Legs with the coxæ and trochanters pale yellow; femora pale yellow basally, more than distal half brownish black; tibiae brownish black; tarsi broken. Wings (Plate 1, fig. 7) with a faint brown tinge, the oval stigma dark brown, conspicuous; veins dark brown, those of the basal third of wing paler. Macrotrichia of veins beyond cord long and conspicuous; basad of cord sparse to lacking, there being none on 1st A and only three or four at outer end of 2d A. Venation: Sc_1 ending just before origin of Rs, Sc_2 far from its tip, Sc_1 alone being nearly as long as Rs alone; cell 1st M_2 closed; m-cu more than one-third its length before the fork of M.

Abdomen, including hypopygium, pale. Male hypopygium (Plate 2, fig. 34) with the caudal margin of tergite, 9t, broadly emarginate. Basistyle, *b*, short, the ventromesal lobe large. Ventral dististyle, *vd*, large and fleshy, its rostral prolongation small and relatively slender, provided with three rostral spines that are placed in a row on basal half of prolongation, the outermost somewhat smaller. Dorsal dististyle strongly curved, the actual tip slightly recurved. Gonapophyses, *g*, with the mesal-apical lobe relatively slender, gently curved, the tips acute.

Habitat.—China (Szechwan).

Holotype, male, Mount Omei, altitude 4,000 feet, August 3, 1931 (*Franck*).

Limonia (Dicranomyia) trispinula is readily told from similar regional species by the dark stigma of wings, the long Sc_1 , basal position of m-cu, and other characters. Since the type is unique, it is not entirely certain that the feature of a trispinous rostral prolongation is constant.

LIMONIA (RHIPIDIA) GARRULA sp. nov. Plate 1, fig. 8; Plate 2, fig. 35.

Belongs to the *rostrifera* group; general coloration dark brown, the thoracic pleura yellowish gray, variegated with dark brown; antenna (male) with all but the terminal flagellar segment long-bipectinate; tarsi extensively snowy white; wings with the apex and stigma conspicuously darkened; extensive milky white areas before and beyond stigma; abdominal segments black, the caudal margins buffy yellow; male hypopygium with two rostral spines.

Male.—Length, about 6 millimeters; wing, 6.

Rostrum about one-half the length of remainder of head, black; palpi concolorous. Antennæ (male) with the scape dark brown; pedicel brownish yellow; flagellar segments with the basal enlargement and branches dark brown, the long apical pedicel whitish; terminal segment uniformly darkened; flagellar segments 1 to 11, inclusive, each with two long branches, those of the first and eleventh segments slightly more than one-half longer than the segment; longest branches (at midlength of organ) slightly exceeding three times the segments; terminal segment simple, slightly exceeding twice the penultimate segment. Head gray.

Mesonotum dark brown, opaque; humeral region of præscutum obscurely brightened. Pleura yellowish gray, the ventral sternopleurite extensively dark brown; a small brown spot on ventrocephalic portion of anepisternum. Halteres pale yellow. Legs with the fore coxæ small, dark brown; remainder of coxæ and all trochanters yellow; femora and tibiæ yellowish brown to light brown, the tips of the former narrowly darkened; proximal half of basitarsi dark brown, with almost the remainder of tarsi snowy white, only the terminal segment again infuscated; claws with a sharp basal spine. Wings (Plate 1, fig. 8) with the ground color very faintly brownish, the large oval stigma and a confluent cloud over anterior cord dark brown; wing apex in cells R_2 and R_3 conspicuously darkened; very large and conspicuous milky white areas before and beyond stigma; origin of Rs and posterior cord very narrowly and insensibly seamed with brown; veins pale brown, more whitish in the milky areas. Ve-

nation: Sc_1 ending about opposite one-third the length of Rs , Sc_2 exactly opposite origin of Rs ; free tip of Sc_2 lying a little distad of level of R_2 ; cell M_2 open by atrophy of m ; $m-cu$ a short distance beyond fork of M .

Abdominal segments black, their caudal margins broadly and conspicuously ringed with buffy yellow, the latter color including from about one-fourth to nearly one-half the entire segment, the amount decreasing on outer segments; terminal segments dark brown; ventral dististyle of male hypopygium conspicuously whitened. Male hypopygium (Plate 2, fig. 35) with the tergite, $9t$, transverse, the caudal margin very gently emarginate. Basistyle, b , small, the ventromesal lobe proportionately large. Ventral dististyle, vd , a large fleshy lobe, the rostral prolongation small, with two short, gently curved spines that arise from a short, common tubercle. Gonapophyses, g , with the mesal-apical angle slender.

Habitat.—China (Szechwan).

Holotype, male, Mount Omei, altitude 7,000 feet, July 17, 1931 (*Franck*).

Limonia (*Rhipidia*) *garrula* is very different from all other described members of the group. White tarsi are likewise found in *morionella* Edwards and *luteipleuralis* Alexander, but these species have the wings clear except for the stigma and with the mesonotum polished black. As stated elsewhere, I am inclined to believe that the members of the *rostrifera* group are a quite different offshoot from typical *Rhipidia* and may well warrant the erection of a new subgeneric group.

LIMONIA (GERANOMYIA) BIFURCULA sp. nov. Plate 1, fig. 9; Plate 2, fig. 36.

General coloration of mesonotum reddish brown, the præscutum with three blackish stripes, the median one continued caudad onto base of scutellum; rostrum and antennæ black throughout; knobs of halteres brownish black; legs brownish yellow to brown; wings brownish yellow, with a heavy brown pattern that is chiefly costal in distribution; a supernumerary crossvein in cell Sc ; Sc_1 ending about opposite two-thirds the length of Rs ; cell 1st M_2 long and narrow; male hypopygium with the rostral prolongation of the large ventral dististyle long and slender, at its base bearing a single, powerful, decurved spine, the two taken together forming a conspicuous fork; dorsal dististyle a small, nearly straight, needlelike rod.

Male.—Length, excluding rostrum, about 6 to 6.5 millimeters; wing, 6 to 6.5; rostrum, about 2.2 to 2.5.

Female.—Length, excluding rostrum, about 7 to 8 millimeters; wing, 6 to 7.5; rostrum, about 2.2 to 3.

Rostrum and palpi black. Antennæ black throughout; flagellar segments suboval, with short, inconspicuous verticils. Head gray, the posterior vertex with a blackish area on either side of the median line.

Mesonotum brown, more or less pruinose; a capillary, median, blackish vitta extending from the præscutum, crossing the scutum onto the scutellum; slightly broader blackish sublateral stripes; lateral margins and posterior interspaces of præscutum, median area of scutum, and the scutellum somewhat more reddish brown; postnotum black, gray pruinose. Dorsal pleurites brownish black, the ventral sclerites, including the sternopleurite and meron, more yellowish. Halteres yellow, the knobs brownish black. Legs with the coxæ and trochanters yellow; femora obscure brownish yellow; tibiæ and tarsi somewhat darker brown. Wings (Plate 1, fig. 9) with a brownish yellow ground color, the prearcular and costal regions clearer yellow; a restricted dark brown pattern, including about seven costal areas, the third at origin of Rs and fourth at tip of Sc separate; last two areas at ends of the outer radial veins; cord and outer end of cell 1st M_2 narrowly seamed with brown; scarcely evident marginal washes at ends of medial, cubital, and anal veins; veins brown, darker in the infuscated areas. Venation: A supernumerary crossvein in cell Sc at shortly beyond midlength; Sc_1 ending about opposite two-thirds the length of Rs, Sc_2 at its tip; cell 1st M_2 long, exceeding the veins beyond it; m-cu close to fork of M; anal veins at origin very gradually divergent.

Abdominal tergites dark brown, the caudal margins very narrowly pale; basal sternites obscure yellow, the subterminal segments darker; hypopygium dark brown. Male hypopygium (Plate 2, fig. 36) with the tergite, 9t, deeply and narrowly notched medially, the lobes broadly obtuse. Basistyle, *b*, small. Ventral dististyle, *vd*, large and fleshy, the rostral prolongation long and slender, at base bearing a single, powerful, decurved spine that is evidently formed by the union of the usual two spines, the suture being faintly indicated. Dorsal dististyle a small, nearly straight, slender rod, the tip very acute. Gonapophyses, *g*, with the mesal-apical lobe slender. Lateral portions of ædeagus with delicate setulæ.

Habitat.—China (Szechwan).

Holotype, male, Mount Omei, altitude 3,500 feet, July 9, 1931 (*Franck*). Allotopotype, female. Paratopotypes, 8 of both sexes, with the types; 2 females, August 17, 1931.

Limonia (*Geranomyia*) *bifurcula* is generally similar to species such as *L. (G.) avocetta* (Alexander), differing from all such species where the male sex is known by the peculiar structure of the rostral prolongation of the ventral dististyle and its spine. A few members of the same group are known only from the female sex (as *septemnotata* Edwards, of Formosa, and *flavi-ventris* Brunetti, of the eastern Himalayas); these differ most evidently in the details of coloration. The type of male hypopygium found in *bifurcula* is somewhat approached by that of *L. (G.) feuerborni* Alexander (East Indian Islands), but the latter species has unspotted wings.

ANTOCHA (ANTOCHA) PALLIDELLA sp. nov. Plate 1, fig. 10; Plate 3, fig. 37.

General coloration pale yellow, including the antennæ and halteres; tips of femora and tibiæ narrowly blackened; wings subhyaline, with a sparse dark pattern, indicated chiefly by cloudings of the veins comprising the cord and outer end of cell 1st M_2 ; m-cu a little more than its own length before fork of M; male hypopygium with each caudal-lateral angle of tergite bearing a small rounded tubercle; gonapophyses simple; phallosome apparently reduced to the elongate ædeagus.

Male.—Length, about 4.5 millimeters; wing, 5.3.

Rostrum pale yellow, the palpi slightly darker. Antennæ short, pale yellow throughout; flagellar segments oval, the verticils not exceeding the segments. Head testaceous-yellow.

Mesonotum and pleura pale yellow. Halteres pale throughout. Legs pale yellow, the tips of the femora narrowly but conspicuously blackened; tibiæ similarly but even more narrowly blackened; terminal tarsal segments blackened. Wings (Plate 1, fig. 10) broad, subhyaline, the small oval stigma darker; veins pale, the cord, m-cu, and outer end of cell 1st M_2 darker brown. Venation: R_2 lying some distance proximad of r-m, R_{2+3} being about one-half as long as R_{4+5} ; m-cu more than its own length before fork of M.

Abdomen yellow, the outer tergites marked with brownish at centers of disk; hypopygium pale yellow. Male hypopygium (Plate 3, fig. 37) with the tergite, 9t, transverse, the outer lateral angles of the caudal margin produced into low, rounded, seti-

ferous lobes. Outer dististyle, *od*, a gently arcuate darkened blade, the apex obtuse. Gonapophyses, *g*, appearing as simple flattened rods, their tips acutely pointed, these rods subtending the simple, sinuous ædeagus, *a*.

Habitat.—China (Szechwan).

Holotype, male, Mount Ormei, altitude 7,000 feet, July 17, 1931 (*Franck*).

The nearest ally of the present fly is undoubtedly *Antocha* (*Antocha*) *nigribasis* Alexander, likewise from the mountains of Szechwan, which differs most evidently in the usually darkened wing base, even more basal position of m-cu, and the details of the male hypopygium, as the tuberculate caudal margin of the ninth tergite. The two species differ from all allied regional members of the genus in the pale yellow coloration of the body, the narrowly blackened tips of the femora, the basal position of m-cu, and the details of venation of the radial field, as the brevity of R_{2+3} when compared with R_{4+5} .

ANTOCHA (ANTOCHA) SETIGERA sp. nov. Plate 1, fig. 11; Plate 3, fig. 38.

General coloration gray; præscutum with a median brown stripe; antennal flagellum black; knobs of halteres infuscated; legs brown; wings whitish, especially the prearcular region; m-cu about one-half its length before the fork of M; veins beyond cord with unusually abundant macrotrichia; abdominal tergites dark brown, the basal sternites dark medially, paler laterally; male hypopygium with the phallosome relatively narrow, at apex dividing into two short arms.

Male.—Length, about 5.3 millimeters; wing, 6.

Rostrum brown; palpi dark brown. Antennæ (male) of moderate length, if bent backward extending to just beyond the wing root; scape brown, remainder of organ black; flagellar segments oval, terminal segment two-thirds the length of the penultimate; verticils shorter than the segments. Head gray.

Mesonotum dark gray, the præscutum with a median brown stripe and with scarcely indicated lateral stripes. Pleura gray. Halteres pale, the knobs infuscated. Legs with the coxæ yellow, the fore coxæ infuscated on basal half; trochanters yellow; remainder of legs brown. Wings (Plate 1, fig. 11) whitish subhyaline, the prearcular region more milky white; stigma pale brown, ill-delimited; veins brown, pale in the prearcular region. Macrotrichia of veins unusually abundant and conspicuous, being found on distal half of R_3 , all of outer section of R_{4+5} , the entire length of all veins issuing from cell 1st M_2 , almost the

entire length of distal section of Cu_1 and outer half of M_{3+4} ; a few scattered trichia on second section of M_{1+2} and with three or four trichia on distal half of vein 2d A, these widely separated. Venation: R_2 unusually faint, about in transverse alignment with r-m; cell 1st M_2 small, shorter than vein M_{1+2} beyond it; m-cu about one-half its length before fork of M.

Abdominal tergites dark brown; basal sternites darkened medially, paler laterally; hypopygium dark brown. Male hypopygium (Plate 3, fig. 38) with the tergite, 9t, transverse, the central portion of cephalic half with very numerous setæ, the more-lateral ones larger and coarser. Outer dististyle, od, gently arcuated, the distal half blackened, the tip obtusely rounded. Inner dististyle with the apex provided with abundant coarse setæ. Gonapophyses, g, appearing as simple, flattened, dusky rods, their tips subacute. Phallosome, p, of moderate size, narrowed outwardly, the apex dividing into two short, divergent arms.

Habitat.—China (Szechwan).

Holotype, male, Mount Omei, altitude 7,000 feet, July 17, 1931 (*Franck*). Paratopotype, male, altitude 3,500 feet, August 16, 1931 (*Franck*).

Antocha (*Antocha*) *setigera* is told from all regional species of the genus by the structure of the male hypopygium, especially of the phallosome. The coloration of the body and wings and the trichiation of the wing veins likewise furnish somewhat distinctive features.

PEDICIINI

PEDICIA BRACHYCERA sp. nov. Plate 1, fig. 12; Plate 3, fig. 40.

Female.—Length, about 30 millimeters; wing, 25.

Characters much as in *Pedicia daimio* (Matsumura).

Rostrum and palpi black, the terminal segment of the latter subequal to the penultimate. Antennæ much shorter than in *daimio*, 15-segmented, shorter than the head, dark brown throughout; flagellar segments relatively short and crowded. Head gray, the vertical tubercle with a circular depression.

Præscutum light gray, with three darker gray stripes, the median one split on anterior half by a vague paler median vitta. Halteres and legs about as in *daimio*. Wings (Plate 1, fig. 12) with the usual pattern of the genus, the dark seam on distal section of vein Cu_1 becoming obsolete before midlength of vein and thus not reaching the margin, as is the case in *daimio*.

Abdomen conspicuously gray, much darker and more extensively suffused than in *daimio*, the dorsomedian line of tergites darker grayish brown, very narrowly interrupted by the rufous incisures; sternites with the lateral margins broadly gray. Ovipositor with the cerci longer than in *daimio*.

Habitat.—Japan (Honshiu).

Holotype, female, Shirouma-dake, Japanese Alps, August 8, 1931 (*Machida*).

The present insect certainly appears to be distinct from *daimio* in the characters outlined above, notably the short antennæ with small crowded flagellar segments. The antennæ of both of these species have only fifteen segments, whereas the normal number for the genus is sixteen. The condition in the larger members of the closely allied genus (or subgenus) *Tricyphona*, where the number of antennal segments ranges from eleven to sixteen, shows clearly that we are here dealing with a very plastic character that cannot be trusted for generic or tribal separation. The antennal flagella of *daimio* (Plate 3, fig. 39) and of *brachycera* (Plate 3, fig. 40) are herewith compared, the organs being drawn to scale.

PEDICIA SUBTRANSVERSA sp. nov. Plate 1, fig. 13; Plate 3, fig. 41.

General coloration light gray, the præscutum with three brown stripes, the median one split by a capillary gray vitta; wings whitish subhyaline, with the usual triangular dark pattern on disk, the seam on vein Cu₁ continued to margin; cord more nearly transverse than in other species of the genus; R₁₊₂ about two-thirds as long as m-cu; abdomen with the basal segments yellow, the tergites with a nearly continuous median stripe; male hypopygium with the dististyle single, terminal in position, the outer margin with four or five spines.

Male.—Length, about 19 millimeters; wing, 17.

Rostrum very short, black; palpi black, the terminal segment about one-half longer than the penultimate. Antennæ with the scape and pedicel black; remainder of organ broken. Head dark gray, with a moderately developed vertical tubercle.

Pronotum fulvous, infuscated laterally. Mesonotal præscutum light gray, with three brown stripes, the median one somewhat darker, divided by a capillary gray vitta, the stripe narrowed behind and not reaching the suture; lateral stripes more pruinose; scutum gray, the median area more brownish fulvous; scutellum obscure yellow; postnotal mediotergite dark brown, sparsely pruinose, the cephalic portion narrowly more yellowish. Pleura chiefly light gray, the dorsopleural region and pleuro-

tergite more infuscated. Halteres pale yellow, the knobs weakly darkened. Legs with the coxæ light gray; trochanters obscure yellow; femora and tibiæ yellow, the tips narrowly blackened; tarsi black, the proximal portions of basitarsi more or less brightened. Wings (Plate 1, fig. 13) whitish subhyaline, the costal margin light brown, paler beyond the humeral crossvein and before stigma; the usual dark pattern of the genus, including extensive darkenings of cells R and M, a semicircular area at origin of Rs, and a continuous darkening in cells R_2 and R_3 ; seam along vein Cu_1 continued to margin; veins pale yellow, including the darkened areas, in contrast with which they are very conspicuous. Venation: R_{1+2} relatively long, approximately two-thirds of m-cu; cord subtransverse, much less oblique than in the typical members of the genus.

Abdomen with the basal segments yellow, with a nearly continuous dorsomedian brown vitta, narrower and paler on the basal ring; sternites with their caudal margins narrowly light brown; lateral triangular areas on both tergites and sternites near caudal margins of segments, the areas becoming larger on the outer segments. Male hypopygium (Plate 3, fig. 41) with the dististyle, *d*, single, terminal in position; outer margin of style with a series of four or five spines, the more-distal ones larger; disk of style set with smaller black spines. Interbasal process, *i*, a small, narrowly spatulate blade.

Habitat.—Japan (Honshiu).

Holotype, male, Shirouma-dake, Japanese Alps, August 8, 1931 (*Machida*).

Pedicia subtransversa differs from the other species of the genus in the less oblique cord of the wings, which is here almost exactly as in some species of *Tricyphona*. The present species is placed in *Pedicia* chiefly on the possession of the characteristic wing pattern of the group, since the male hypopygium is likewise scarcely typical of the genus, the dististyle being terminal in position. There are two species of *Tricyphona* in Japan (*gaudens* Alexander and *grandior* Alexander) that closely approach *Pedicia*, and the characters hitherto used for the separation of the two groups are gradually becoming untenable.

DICRANOTA (DICRANOTA) NIPPOALPINA sp. nov. Plate 1, fig. 14; Plate 3, fig. 42.

General coloration pale yellow; head light gray; wings relatively long and narrow; Rs more than twice R_{2+3+4} ; cell M_2 open; male hypopygium with the interbase at apex extended into a long powerful spine.

Male.—Length, about 4.5 millimeters; wing, 5.5.

Rostrum pale; basal segments of palpi pale, the outer segments infuscated. Antennæ broken. Head clear light gray; vertex very broad.

Pronotum, mesonotum, and pleura entirely pale yellow, unmarked. Halteres pale, the knobs weakly infuscated. Legs with the coxæ and trochanters pale yellow; femora very pale brown; tibiæ and tarsi whitish, the terminal segments of the latter darkened. Wings (Plate 1, fig. 14) long and narrow, pale yellow throughout; veins pale, not clearly apparent in balsam mounts. Venation: Sc_1 ending shortly before the supernumerary crossvein in cell R_1 , Sc_2 not clearly evident in the unique type; R_{2+3+4} about one-third longer than R_{2+3} ; cell M_1 open.

Abdomen yellow. Male hypopygium (Plate 3, fig. 42) with the caudal margin of tergite, 9t, nearly transverse, conspicuously hairy; lateral arms appearing as small, flattened, gently curved, pale blades, their tips obtuse. Basistyle, b , with the outer lobe short and stout, with long setæ and a few spines; mesal face of basistyle near cephalic end with a group of very long coarse setæ. Interbase, i , at apex bent at nearly a right angle into a long acute spine.

Habitat.—Japan (Honshiu).

Holotype, male, Shirouma-dake, Japanese Alps, August 8, 1931 (Machida).

Dicranota (Dicranota) nipponalpina is very distinct from the other species of the subgenus in eastern Asia in the almost uniform pale yellow color of the body and wings and in the long, nearly straight, radial sector.

DICRANOTA (RHAPHIDOLABIS) SINOALPINA sp. nov. Plate 1, fig. 15; Plate 3, fig. 43.

General coloration gray; antennæ black throughout, 13-segmented; mesonotal præscutum with a median blackish stripe; knobs of halteres infuscated; legs pale yellow; wings subhyaline, the stigmal area very slightly darkened; R_{2+3+4} distinct; cell 1st M_2 open; male hypopygium with the tergite not or scarcely produced medially, setiferous; interbase a stout rod, the apex acute.

Male.—Length, about 4.5 millimeters; wing, 5.

Female.—Length, about 5.5 millimeters; wing, 6.

Rostrum and palpi black. Antennæ short, black throughout. Head gray.

Pronotum and mesonotum dark gray, the præscutum with a conspicuous, median, blackish stripe, the lateral stripes much

less conspicuous. Pleura dark gray. Halteres pale, the knobs infuscated. Legs with the coxæ infuscated; trochanters whitish; remainder of legs pale yellow, the outer tarsal segments darkened; in female, the tips of femora and tibiæ weakly infumed. Wings (Plate 1, fig. 15) subhyaline, the stigmal area very diffusely and faintly darkened; veins very pale. Venation: R_{2+3+4} distinct, subequal to $r-m$; R_{1+2} about one-half of R_2 ; cell 1st M_2 open; $m-cu$ oblique, more than one-half its length beyond fork of M .

Abdomen, including hypopygium, brownish black. Male hypopygium (Plate 3, fig. 43) with the caudal margin of the tergite, 9t, nearly transverse to slightly convex, densely setiferous; lateral angles of tergite produced into small, slender rods. Basistyle, *b*, with the outer apical lobe slightly produced, with small setæ but no spines. Interbase, *i*, a stout rod, the apex narrowed into a slender spine, the surface of style beyond midlength with five or six small setæ. Outer dististyle, *od*, with spinous setæ. Inner dististyle, *id*, slender, the apex obtusely rounded. Phallosome, *p*, depressed, clothed with abundant delicate setulæ, each outer lateral angle a little produced into a slender lobe. Ovipositor with the long valves horn-colored.

Habitat.—China (Szechwan).

Holotype, male, Mount Omei, altitude 7,000 feet, July 17, 1931 (Franck). Allotopotype, female.

Dicranota (*Rhaphidolabis*) *sinoalpina* is most readily told from its few allies in the Himalayas and Japan by the structure of the male hypopygium, in conjunction with the coloration of the body, legs, and wings, and the number of antennal segments. The Himalayan species described by Brunetti (*brunettii* Edwards, synonym *aperta* Brunetti, preoccupied; *fascipennis* Brunetti; *sordida* Brunetti, synonym *indica* Brunetti) all have the antennæ 15-segmented. The range in number of antennal segments in *Rhaphidolabis*, where in a single species (*stigma* Alexander, of western North America) or even in a single specimen, the antennal segments range in number from twelve to fourteen, has been indicated by the writer in another paper.⁴

HEXATOMINI

TROGLOPHILA SZECHWANENSIS sp. nov. Plate 1, fig. 16.

General coloration light brown; wings with cell M_1 present; R_{1+2} shorter than R_{2+3+4} , the latter more than three times R_{2+3} alone.

⁴Proc. U. S. Nat. Mus. 64, art. 10 (1924) 14-15.

Female.—Length, about 4 millimeters; wing, 5.

Rostrum and palpi brown. Antennæ dark brown throughout; flagellar segments cylindrical, the verticils becoming longer and more conspicuous on the outer segments. Head light brown.

Mesonotum light brown, without evident markings. Pleura testaceous-brown, slightly variegated by darker areas on anepisternum, dorsal sternopleurite, and meron. Halteres dusky, the base of stem narrowly yellow. Legs with the coxæ and trochanters yellowish testaceous; femora and tibiæ brown, the tarsi a trifle paler. Wings (Plate 1, fig. 16) with a strong brown tinge; stigma lacking; veins pale brown, the macrotrichia darker. Venation: R_{1+2} shorter than R_{2+3+4} , the latter more than three times R_{2+3} alone and longer than cell 1st M_2 ; cell M_1 present; m-cu at fork of M.

Abdomen dark brown. Ovipositor with the cerci fleshy, oval, narrowed outwardly, each valve terminating in a slender yellow point; hypovalvæ short and very obtusely rounded.

Habitat.—China (Szechwan).

Holotype, female, Mount Omei, altitude 3,500 feet, August 17, 1931 (Franck).

Troglophila szechwanensis requires comparison only with *T. seticornis* Alexander (eastern China), which differs especially in the venation of the radial field, having R_{2+3+4} short, less than R_{1+2} and shorter than cell 1st M_2 .

ERIOCERA (ERIOCERA) HEMICERA sp. nov. Plate 1, fig. 17.

Belongs to the *spinosa* group; general coloration of head and thorax black, gray pruinose; antennæ (male) elongate, a little shorter than the body; mesonotal præscutum with three black stripes; fore and middle femora yellow, their tips narrowly blackened; posterior femora chiefly black; wings with a strong fulvous-brown tinge, the oval stigma pale brown; cell M_1 present; abdomen chiefly fulvous-brown, including the genitalia of both sexes.

Male.—Length, about 16 millimeters; wing, 16; antenna, about 14.

Female.—Length, about 23 millimeters; wing, 19; antenna, about 6.

Rostrum and palpi black. Antennæ (male) 7-segmented, relatively elongate but still shorter than body, black throughout; basal two flagellar segments with long, spinous setæ, there being about twelve to fifteen to each of these segments; on outer segments these spines are more appressed and merge with the

ordinary setæ; terminal segment very small; antennæ (female) 11-segmented, black, the scape slightly paler beneath. Head blackish, gray pruinose.

Mesonotal præscutum with three black stripes, the humeral and sublateral portions more golden yellow pollinose, the interspaces more infuscated; extreme lateral margins of præscutum velvety black; posterior sclerites of mesonotum black, the scutum slightly pollinose, the scutellum more heavily so. Pleura black, gray pruinose. Halteres with the stem brownish yellow, the knobs black. Legs with the coxæ gray pruinose; fore trochanters brown, the others more yellowish; fore and middle femora yellow, their tips narrowly blackened; posterior femora black, only the extreme bases obscure yellow; tibiæ and tarsi black. Wings (Plate 1, fig. 17) with a strong fulvous-brown tinge, the prearcular region and cell Sc light yellow; stigma oval, slightly darker brown than the ground; vague whitish longitudinal streaks in basal cells R to 2d A, inclusive; veins of radial field, M, Cu, and 2d A, narrowly bordered by yellow; veins pale brownish yellow, those of outer medial field very slender and faint. Macrotrichia of costa short but very dense; a few trichia on veins of outer radial field; Sc, Rs, and veins of medial, cubital, and anal fields without trichia. Venation: R_{2+3+4} a little shorter than basal section of R_5 ; R_{2+3} longer than R_{1+2} but a little shorter than R_3 alone; cell M_1 present, longer than its petiole.

Abdomen with basal tergite black, the succeeding segments fulvous-brown; sternites clearer fulvous; genital segments of both sexes fulvous. Ovipositor with the valves long and slender.

Habitat.—China (Szechwan).

Holotype, male, Mount Omei, altitude 3,500 feet, August 16, 1931 (*Franck*). Allotopotype, female, August 17, 1931.

I consider that the present species is most nearly allied to *Eriocera* (*Eriocera*) *stricklandi* Edwards, and a few related regional forms. The body is not strikingly hairy and the fulvous-brown ground color of the wings is quite different from the other described members of the *spinosa* group. By Edwards's key to the Old World species of *Eriocera*⁵ the present fly runs to couplet 27, disagreeing with the various indicated characters by the presence of a stigma and in the fact that R_{1+2} is approximately twice as long as R_2 .

⁵ Ann. & Mag. Nat. Hist. IX 8 (1921) 70-78.

ERIOPTERINI

LIPSOTHRIX TOKUNAGAI sp. nov. Plate 1, fig. 18; Plate 3, fig. 44.

General coloration pale yellow, including the body, halteres, and wings; veins pale yellow.

Male.—Length, about 7 millimeters; wing, 6.

Antennæ broken. Head brownish yellow.

Mesonotum, pleura, and halteres entirely pale yellow. Legs with the coxæ and trochanters pale yellow; femora pale yellow, broken before tips; remainder of legs broken. Wings (Plate 1, fig. 18) entirely pale yellow; veins pale yellow, some of the elements almost invisible in microscopic mounts; macrotrichia brown. Venation: Sc_1 ending just beyond fork of R_s , Sc_2 faint, placed close to its tip; veins R_3 and R_4 extending parallel to one another for most of their length, a little divergent at tips.

Abdomen entirely pale yellow, only the outer dististyle darkened. Male hypopygium (Plate 3, fig. 44) with the outer dististyle, *od*, bearing the usual appressed tooth on inner margin at about two-thirds the length. Interbase, *i*, long and sinuous.

Habitat.—Japan (Honshiu).

Holotype, male, Mount Daisen, Tottori, July 2, 1931 (*Tokunaga*).

It is with great pleasure that I dedicate this striking new *Lipsothrix* to Dr. Masaaki Tokunaga. The present fly is readily told from the other species in eastern Asia by the uniform pale yellow coloration of the body and wings. The other species are from Formosa and the Riukiu Islands, the present record being the first from the major islands of Japan. The name *Electrolabis* Alexander⁶ should be placed in the synonymy of *Lipsothrix* and extends the range of the genus back to the Lower Oligocene (Baltic amber).

GONOMYIA (PTILOSTENA) *ABJECTA* sp. nov. Plate 1, fig. 19; Plate 3, fig. 45.

General coloration gray; basal two segments of antennæ yellow, the remainder black; pleura striped; femora and tibiæ yellow, the tips of the latter, together with the tarsi, black; wings with a strong yellow tinge; stigma small, pale brown; Sc_1 ending about opposite midlength of R_s , Sc_2 before this origin; veins R_{1+2} and R_3 closely approximated at wing margin; male hypopygium with the outer dististyle bifid, each arm terminating in an acute spine; inner dististyle a simple spine; ædeagus without blackening.

Male.—Length, about 4.5 millimeters; wing, 5 to 5.2.

⁶ Bernsteinforschungen Heft 2 (1931) 58–59, figs. 68–70.

Female.—Length, about 5.5 to 6 millimeters; wings, 5 to 5.6.

Rostrum and palpi brownish black. Antennæ with the scape and pedicel light yellow; flagellum black, the basal segment somewhat paler; flagellar segments elongate to fusiform, the verticils exceeding the segments. Head flesh-colored, the center of the posterior vertex gray.

Pronotum grayish brown medially above, the lateral portions and the anterior lateral pretergites light yellow. Mesonotal præscutum light gray, the humeral and lateral portions restrictedly yellow; posterior sclerites of mesonotum uniformly darkened, gray pruinose. Pleura with the dorsal portion gray pruinose, clearer brown along the ventral margin, the ventral sternopleurite more reddish brown; an obscure yellow longitudinal stripe extending from behind the fore coxæ to beneath the halteres, this sometimes poorly indicated. Halteres pale yellow, the knobs infuscated. Legs with the fore coxæ darkened, the remaining coxæ and all trochanters yellowish testaceous; femora and tibiæ yellow, the latter narrowly darkened at tips; tarsi black. Wings (Plate 1, fig. 19) with a strong yellowish tinge; stigma small, pale brown; veins pale yellowish brown. Venation: Sc_1 ending about opposite midlength of Rs , Sc_2 some distance before origin of Rs ; R_{1+2} and R_3 approximated to practically contiguous at margin.

Abdominal tergites blackened, their lateral margins narrowly yellow, in cases, also with the caudal margins narrowly pale; sternites yellow, vaguely darkened medially. Male hypopygium (Plate 3, fig. 45) with the apical lobe of basistyle, *b*, simple, obtusely rounded. Outer dististyle, *od*, bifid, both arms ending in acute black spines. Middle dististyle, *md*, with both arms expanded, the inner shorter, suboval in outline, the margin of the notch of the style blackened. Inner dististyle, *id*, simple, terminating in a blackened spine. Ædeagus, *a*, without blackening, subtended by a narrow flange, at its widest part with about a dozen pale setæ.

Habitat.—China (Szechwan).

Holotype, male, Mount Omei, altitude 7,000 feet, July 17, 1931 (*Franck*). Allotopotype, female, with the type. Paratopotypes, 4 females; paratype, 1 male, altitude 4,000 feet, July 21, 1931 (*Franck*).

Gonomyia (Ptilostena) abjecta is quite distinct from the other described regional species of the subgenus in the structure of the male hypopygium, taken in conjunction with the wing pattern and details of venation. In the male hypopy-

gium, especially the entirely pale ædeagus, the fly comes closest to *G. (P.) shantungensis* Alexander (China and Japan), which has a distinct radial venation and a profoundly divided outer dististyle of the hypopygium. The species *pallens* Alexander and *teranishii* Alexander, both of Japan, have the ædeagus heavily blackened and variously toothed near the apex.

GONOMYIA (LIPOPHLEPS) ANGULIFERA sp. nov. Plate 1, fig. 20; Plate 3, fig. 46.

General coloration dark grayish brown; posterior margin of scutellum obscure yellow; pleura dark, with a silvery longitudinal stripe; halteres pale yellow; femora yellow, with a conspicuous, dark brown, subterminal ring; wings broad, pale brownish, variegated with whitish hyaline areas; Sc short; male hypopygium with the outer dististyle entirely blackened, profoundly bifid at base, the two arms microscopically toothed and roughed at tips.

Male.—Length, about 2.8 millimeters; wing, 3.2.

Rostrum and palpi blackish. Basal segments of antennæ obscure yellow above, darker beneath; flagellum black. Head dark grayish brown.

Anterior lateral pretergites very restrictedly yellow. Mesonotum dark grayish brown, the posterior margin of scutellum obscure yellow; pseudosutural foveæ shiny black. Pleura brownish black, with a single, silvery, longitudinal stripe. Halteres pale yellow, the base of stem narrowly darkened. Legs with the fore coxæ chiefly silvery, remaining coxæ more yellowish, their bases narrowly darkened; trochanters obscure yellow, the fore pair darker; femora yellow, with a conspicuous dark subterminal ring; remainder of legs pale yellow, the terminal tarsal segments darker. Wings (Plate 1, fig. 20) broad, the ground color pale brownish, conspicuously variegated by more-whitish hyaline areas, including a nearly complete crossband before cord, with other smaller clear areas beyond stigma, in cell 1st M_2 , and in the outer medial cells; cells Cu and 1st A less evidently variegated by pale areas; stigma pale brown, a little darker than the ground; prearcular and costal regions slightly clearer yellow; veins pale, darker in the clouded areas. Venation: Sc short, Sc_1 ending before origin of Rs, the distance about equal to one-half the length of the latter, Sc_2 not clearly apparent in the unique type but apparently placed close to tip of vein; anterior branch of Rs diverging strongly from

the posterior branch, about one-fourth longer than Rs; cell 1st M_2 closed.

Abdomen chiefly dark brown, the caudal margins of the more-basal segments slightly more yellowish; hypopygium dark. Male hypopygium (Plate 3, fig. 46) with what appears to represent lateral tergal lobes, 9t, cylindrical, each tipped with a small blackened spine. Outer dististyle, od, heavily blackened, profoundly bifid at extreme base, the two arms divergent at about a right angle; basal arm shorter, its apex a little expanded into a microscopically roughened head; outer arm similarly expanded at distal end, the outer margin with a few, small, retrorse spines. Inner dististyle a slender, simple, pale rod, with numerous setæ, including two larger fasciculate setæ at apex. Phallosome, p, not in condition to be described or figured in the unique type, consisting of two slender, curved, blackened arms, in addition to a complicated development of the ædeagus.

Habitat.—China (Szechwan).

Holotype, male, Mount Omei, altitude 7,000 feet, July 17, 1931 (Frank).

Gonomyia (*Lipophleps*) *angulifera* is very distinct from all other regional species known to me in the structure of the male hypopygium, especially of the outer dististyle. By Edwards's key to the Oriental species of *Lipophleps*¹ the present fly runs to *subnebulosa* Edwards (Pahang), which is still known only from the female sex. This species has a quite different venation and pattern of the wing.

ORMOSIA LÆVISTYLA sp. nov. Plate 1, fig. 21; Plate 3, fig. 47.

Belongs to the *aculeata* group; large (wing, male, 7.5 millimeters); halteres light yellow; male hypopygium with the outer dististyle smooth, with a rounded basal lobe; inner dististyle obtuse at tip.

Male.—Length, about 6 millimeters; wing, 7.5.

Palpi and antennæ black. Head black, probably pruinose in fresh specimens.

Mesothorax discolored in the unique type, black, presumably gray pruinose in fresh specimens. Halteres pale. Legs with the coxæ concolorous with the thorax; trochanters obscure yellow; remainder of legs broken. Wings (Plate 1, fig. 21)

¹ Journ. Fed. Malay St. Mus. 14 (1928) 104–105.

with the ground color whitish; stigma and narrow seams along cord, Sc_2 , tip of R_3 , and m infuscated; outer end of cell 2d M_2 less evidently clouded; veins brown; a more-whitish obliterative area across the fork of vein M. Venation: R_2 just beyond fork of R_{2+3+4} ; veins R_3 and R_4 slightly upcurved at tips; cell 1st M_2 open; m transverse, meeting the outer section of M_3 at a spurred right angle; m-cu just before fork of M; vein 2d A sinuous.

Abdomen black, pruinose, with numerous white setæ; hypopygium brownish black. Male hypopygium (Plate 3, fig. 47) with the basistyle, *b*, produced at apex into a small chitinized spine, as in the group. Outer dististyle, *od*, smooth, with a flattened, earlike lobule at base. Inner dististyle, *id*, blunt at apex, the distal third with small setulæ.

Habitat.—Japan (Honshiu).

Holotype, male, Kibune, Kyoto-fu, altitude 750 feet, April 20, 1930 (*Tokunaga*).

Ormosia lævistyla is allied to *O. aculeata* Alexander and *O. horiana* Alexander, likewise from Japan, differing especially in the large size and structure of the male hypopygium. The small, obtuse, basal lobe of the outer dististyle is quite different from that found in the two species mentioned, where this lobe is prolonged into acute spines (two smooth spines in *horiana*; a single roughened to spiculose arm in *aculeata*).

ORMOSIA AURICOSTA sp. nov. Plate 1, fig. 22.

General coloration of mesonotal præscutum and scutum reddish brown, the postnotum and pleura abruptly blackened; antennæ chiefly pale; legs yellow, the femora with a scarcely indicated subterminal brown ring; wings infuscated, the costal border conspicuously golden yellow, the cord and apices of the marginal longitudinal veins with narrow seams and spots of darker brown; m-cu more than one-half its length before the fork of M.

Female.—Length, about 4.6 millimeters; wing, 5.

Rostrum and palpi black. Antennæ chiefly pale; flagellar segments subcylindrical, with long conspicuous verticils. Head dark.

Mesonotal præscutum and scutum reddish brown, the scutellum a little darker. Pleura and postnotum blackened. Halteres with the stem pale, knobs broken. Legs with the coxæ

brownish black; trochanters brownish yellow; femora golden yellow, with a narrow, scarcely indicated, brown, subterminal ring; fore femora with an additional pale brown ring at about one-third the length, this ring subequal in width to the subterminal darkening and about one-third as extensive as the yellow medial annulus; tibiæ and basitarsi light yellow, the terminal tarsal segments dark brown. Wings (Plate 1, fig. 22) with the ground color strongly infuscated, the costal region broadly golden yellow; cells C and Sc variegated with darker only at arculus and Sc₂; outer ends of cells Sc₁, R₂, and R₃ with similar yellow marginal areas that are evidenced chiefly by the yellow costal vein; an oblique, more-whitish area across the cord, including the outer end of cell R and the extensive basal portion of the united cell 1st M₂ and M₃; narrow darker seams and spots at ends of longitudinal veins, along cord, and at fork of M₁₊₂; a pale spot before outer end of vein 2d A; axillary margin narrowly pale yellow; veins dark, luteous in the yellow areas. Venation: Sc₁ ending just beyond R₂, Sc₂ about opposite two-fifths the length of Rs; tips of veins R₃ and R₄ slightly upcurved; inner end of cell 2d M₂ almost squarely truncated; m-cu about one-half its length before fork of M; vein 2d A only gently sinuous on distal third.

Abdomen black, the genital shield of ovipositor obscure yellow; cerci powerful, horn-colored, very gently upcurved to their acute tips.

Habitat.—China (Szechwan).

Holotype, female, Mount Omei, altitude 3,500 feet, August 16, 1931 (*Franck*).

Ormosia auricosta is readily told from other regional allied species by the pattern of the wings and legs. The yellow femora distinguish it from the Himalayan and Chinese species so far described.

ERIOPTERA (ERIOPTERA) JUVENILIS sp. nov. Plate 1, fig. 23.

General coloration of mesonotum light gray, the præscutum with a more-brownish median stripe that is further split on cephalic half by a capillary blackened vitta; antennæ with the basal three flagellar segments partly united into a fusion segment; basal segments of flagellum yellow; knobs of halteres blackened; legs beyond trochanters black; wings broad, light yellow; vein 2d A unusually long and sinuous; abdomen dark brown.

Female.—Length, about 5 millimeters; wing, 5.7.

Rostrum and palpi black. Antennæ with the scape and pedicel dark brown; basal five segments of flagellum light yellow, the terminal segments passing to brown; basal three flagellar segments large and partly fused into a single structure, the succeeding segments distinct; verticils nearly as long as the segments. Head with the center of vertex brownish black, the orbits narrowly light gray.

Pronotum narrowly darkened medially above, yellow on sides. Mesonotal præscutum light gray, with a broad, more brownish gray, median stripe that is delimited laterally by the darkened punctures of the interspaces; a further more-blackened capillary line on cephalic half of sclerite, broadest in front, narrowed to a point about opposite the level of the pseudosutural foveæ; humeral region and lateral margins of præscutum restrictedly pale yellow; posterior sclerites of mesonotum more grayish brown, the postnotal mediotergite even darker. Pluera plumbeous gray, the dorsopleural membrane testaceous-yellow; no trichia on pteropleurite except near extreme dorsocaudal portion. Halteres pale yellow, the knobs and outer end of stem blackened. Legs with the fore coxæ brownish plumbeous, the remaining coxæ a trifle paler; trochanters obscure yellow; remainder of legs black. Wings (Plate 1, fig. 23) broad, clear light yellow, somewhat more obscured beyond cord; stigmal region insensibly darkened; veins deep yellow; macrotrichia pale brown. Venation: M_3 very strongly deflected cephalad at outer end, M_4 and Cu_1 less strongly so; vein 2d A unusually long and sinuous, cell 1st A being strongly widened at midlength.

Abdomen dark brown. Ovipositor with the cerci yellowish horn-color, smooth; hypovalvæ blackened, except for a paler ventral coloration at base.

Habitat.—Japan (Honshiu).

Holotype, female, Shirouma-dake, Japanese Alps, August 8, 1931 (*Machida*).

Erioptera (*Erioptera*) *juvenilis* is most nearly allied to *E. (E.) horii* Alexander and *E. (E.) orbitalis* Alexander, both of northern Japan, differing very evidently in the black legs, the broad wings, and the details of the body coloration.

ERIOPTERA (ERIOPTERA) LEUCOSTICTA sp. nov. Plate 1, fig. 24; Plate 3, fig. 48.

Belongs to the *alboguttata* group; general coloration of mesonotum yellowish brown; pleura obscure yellow, striped longi-

tudinally with dark brown; wings brown, with a conspicuous white-spotted pattern, including a large area in outer ends of both anal cells, basad of the spot at end of vein 2d A; male hypopygium with the outer dististyle without lateral spine; inner dististyle with a linear groove or incision at apex; gonapophyses terminating in long slender blackened points, the concave portion of these structures densely setiferous.

Male.—Length, about 3 millimeters; wing, 3.5.

Rostrum brownish black; palpi black. Antennæ with the scape and pedicel black, the flagellum more brownish black, with long, conspicuous verticils. Head light yellow.

Pronotum brownish yellow. Anterior lateral pretergites whitish. Mesonotum brown laterally, the disk of præscutum and the scutal lobes more yellowish brown; scutellum and post-notal mediotergite more infuscated. Pleura obscure yellow, longitudinally striped with dark brown, the dorsal stripe narrow, the ventral one broader, including the ventral sternopleurite and meral regions. Halteres pale yellow, with yellow setæ. Legs with the coxæ dark brown; trochanters obscure yellow, their tips weakly darkened; femora deep reddish yellow; tibiæ and tarsi light golden yellow. Wings (Plate 1, fig. 24) brown, with a conspicuous white-spotted pattern as in the group, including the following areas: Origin of Rs; marginal series at ends of all longitudinal veins with the exception of R_5 , that at M_{1+2} very small; areas becoming progressively larger backwards from the wing tip, that at 2d A again reduced in size; a major white area occupies cells 1st A and 2d A at the level of the origin of Rs; a continuous white band along cord; a spot at fork of M_{3+4} ; basal portion of wing more yellowish brown, the posterior arcular region strongly infuscated; veins yellow, almost invisible in the white areas. Venation: Vein 2d A rather strongly sinuous.

Abdomen brownish black, the hypopygium somewhat brighter. Male hypopygium (Plate 3, fig. 48) much as in *alboguttata*. Outer dististyle, *od*, without lateral spine at base of club, as in *paivai*. Inner dististyle, *id*, with the apex split by a deep linear groove, the terminal spine blackened; surface of style with only one or two punctures. Gonapophyses, *g*, with long, slender, black, apical points, the concave face of the structures with numerous setæ.

Habitat.—China (Szechwan).

Holotype, male, Mount Omei, altitude 7,000 feet, July 17, 1931 (Franck).

Erioptera (Erioptera) leucosticta is most nearly allied to *E. (E.) alboguttata* Edwards (Formosa) and *E. (E.) paivai* Alexander (eastern Himalayas), differing from both in the structure of the male hypopygium and in the presence of an added white spot in the outer ends of both anal cells basad of the one at end of vein 2d A. In *alboguttata* this region of the wing is vaguely paler but without a clearly defined white area similar to those elsewhere on the wing surface.

ILLUSTRATIONS

[Legend: *a*, Aedeagus; *b*, basistyle; *d*, dististyle; *dd*, dorsal dististyle; *g*, gonapophysis; *i*, interbase; *id*, inner dististyle; *mb*, ventro-mesal lobe of basistyle, detail; *md*, middle dististyle; *od*, outer dististyle; *p*, phallosome; *s*, sternite; *t*, tergite; *vd*, ventral dististyle.]

PLATE 1

- FIG. 1. *Trichocera reticulata* sp. nov., venation.
 2. *Tipula machidai* sp. nov., venation.
 3. *Tipula* (*Formotipula*) *luteicorporis* sp. nov., venation.
 4. *Limonia* (*Limonia*) *lackschewitziana* sp. nov., venation.
 5. *Limonia* (*Limonia*) *commixta* sp. nov., venation.
 6. *Limonia* (*Dicranomyia*) *shinanoensis* sp. nov., venation.
 7. *Limonia* (*Dicranomyia*) *trispinula* sp. nov., venation.
 8. *Limonia* (*Rhipidia*) *garrula* sp. nov., venation.
 9. *Limonia* (*Geranomyia*) *bifurcula* sp. nov., venation.
 10. *Antocha* (*Antocha*) *pallidella* sp. nov., venation.
 11. *Antocha* (*Antocha*) *setigera* sp. nov., venation.
 12. *Pedicia brachycera* sp. nov., venation.
 13. *Pedicia subtransversa* sp. nov., venation.
 14. *Dicranota* (*Dicranota*) *nippoalpina* sp. nov., venation.
 15. *Dicranota* (*Rhaphidolabis*) *sinoalpina* sp. nov., venation.
 16. *Troglophila szechwanensis* sp. nov., venation.
 17. *Eriocera* (*Eriocera*) *hemicera* sp. nov., venation.
 18. *Lipsothrix tokunagai* sp. nov., venation.
 19. *Gonomyia* (*Ptilostena*) *abjecta* sp. nov., venation.
 20. *Gonomyia* (*Lipophleps*) *angulifera* sp. nov., venation.
 21. *Ormosia laevistyla* sp. nov., venation.
 22. *Ormosia auricosta* sp. nov., venation.
 23. *Erioptera* (*Erioptera*) *juvenilis* sp. nov., venation.
 24. *Erioptera* (*Erioptera*) *leucosticta* sp. nov., venation.

PLATE 2

- FIG. 25. *Tipula machidai* sp. nov., male hypopygium, lateral aspect.
 26. *Tipula machidai* sp. nov., male hypopygium, ninth tergite.
 27. *Tipula machidai* sp. nov., male hypopygium, ninth sternite.
 28. *Tipula machidai* sp. nov., male hypopygium, dististyles.
 29. *Tipula* (*Formotipula*) *luteicorporis* sp. nov., male hypopygium, lateral aspect.
 30. *Tipula* (*Formotipula*) *luteicorporis* sp. nov., male hypopygium, ninth tergite.
 31. *Tipula* (*Formotipula*) *luteicorporis* sp. nov., male hypopygium, eighth sternite.
 32. *Limonia* (*Limonia*) *lackschewitziana* sp. nov., male hypopygium.
 33. *Limonia* (*Limonia*) *commixta* sp. nov., male hypopygium.
 34. *Limonia* (*Dicranomyia*) *trispinula* sp. nov., male hypopygium.
 35. *Limonia* (*Rhipidia*) *garrula* sp. nov., male hypopygium.
 36. *Limonia* (*Geranomyia*) *bifurcula* sp. nov., male hypopygium.

PLATE 3

- FIG. 37. *Antocha (Antocha) pallidella* sp. nov., male hypopygium.
38. *Antocha (Antocha) setigera* sp. nov., male hypopygium.
39. *Pedicia daimio* (Matsumura), antennal flagellum, female.
40. *Pedicia brachycera* sp. nov., antennal flagellum, female.
41. *Pedicia subtransversa* sp. nov., male hypopygium.
42. *Dicranota (Dicranota) nipponalpina* sp. nov., male hypopygium.
43. *Dicranota (Rhaphidolabis) sinoalpina* sp. nov., male hypopygium.
44. *Lipsothrix tokunagai* sp. nov., male hypopygium.
45. *Gonomyia (Ptilostena) abjecta* sp. nov., male hypopygium.
46. *Gonomyia (Lipophleps) angulifera* sp. nov., male hypopygium.
47. *Ormosia lævistyla* sp. nov., male hypopygium.
48. *Erioptera (Erioptera) leucosticta* sp. nov., male hypopygium.

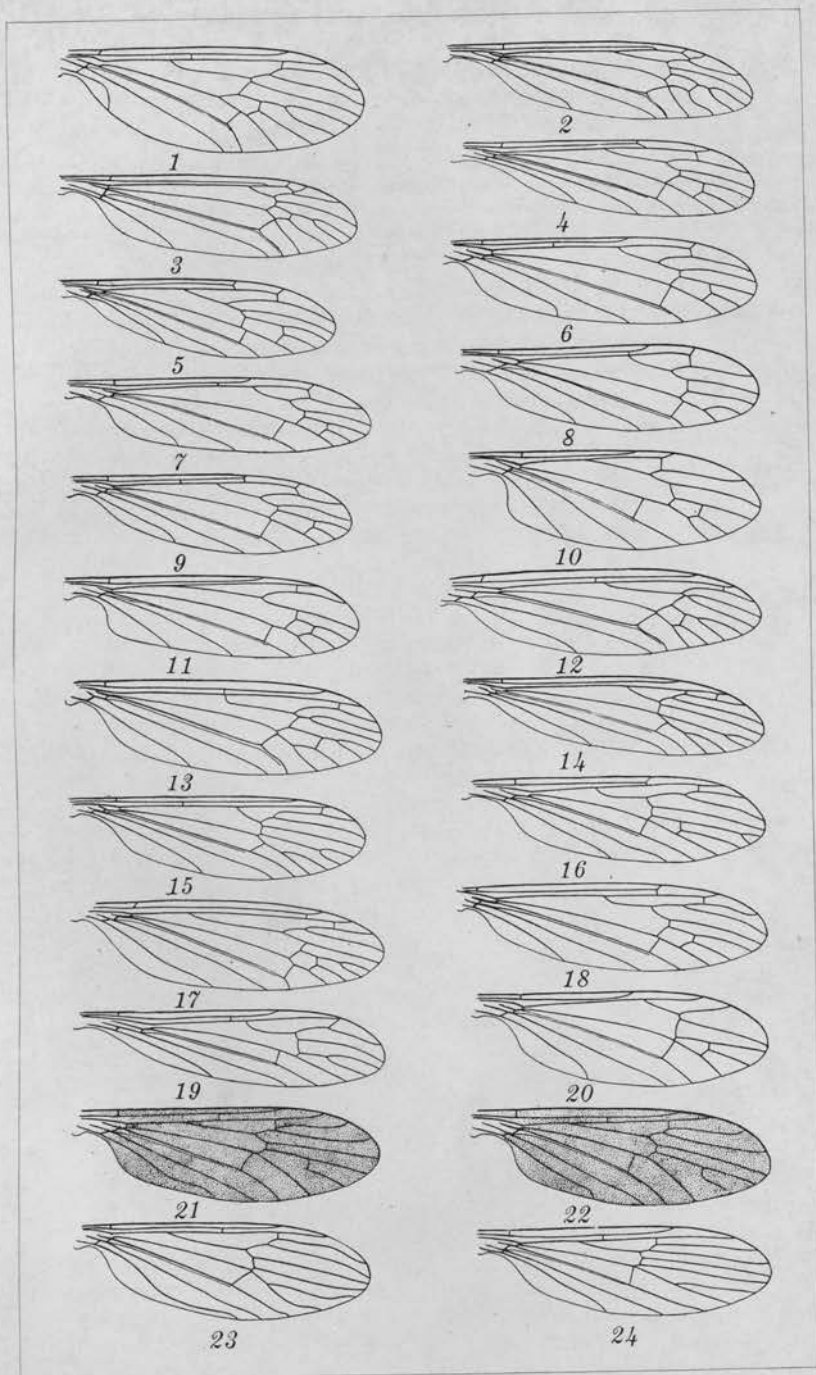


PLATE 1.

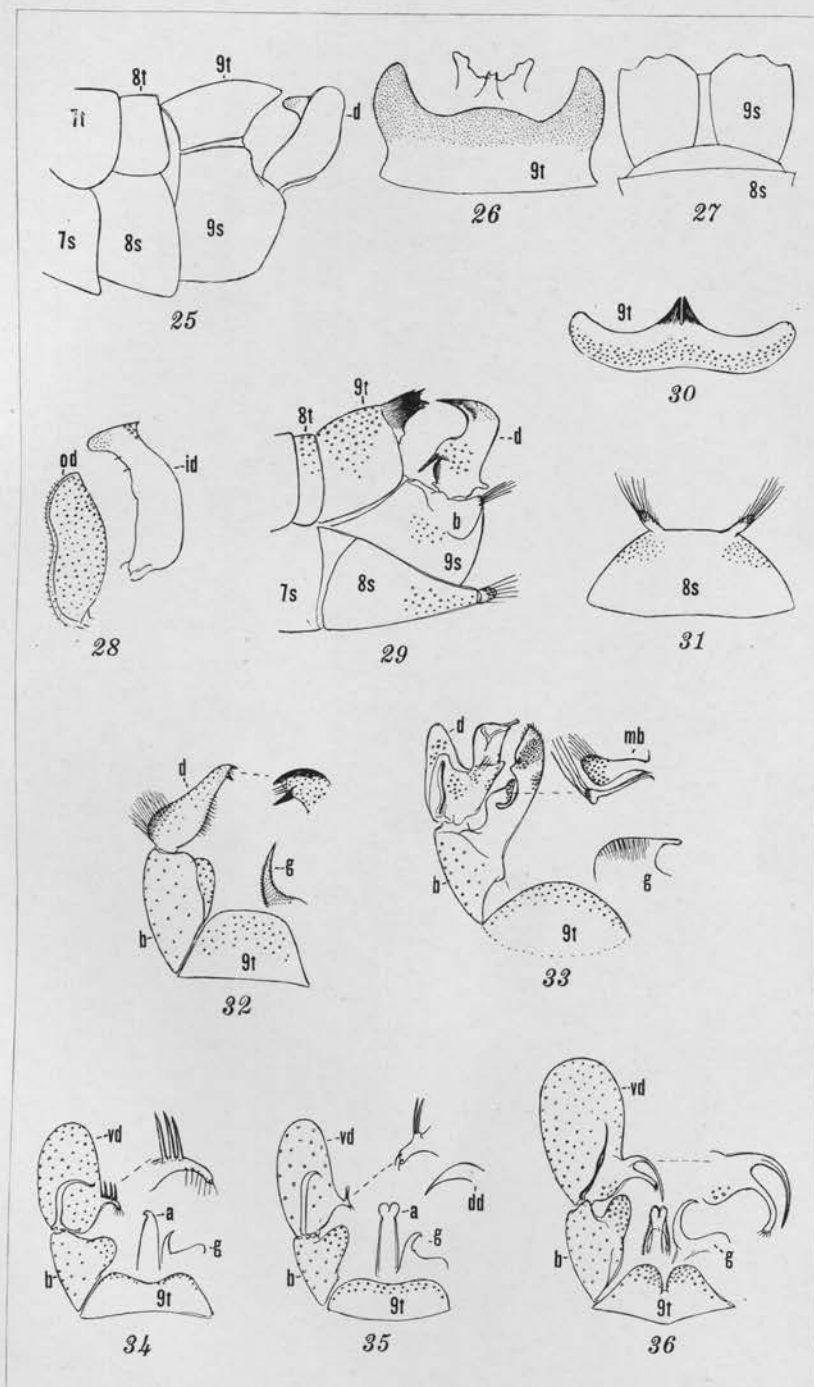


PLATE 2.

EINE ERWEITERTE BESTIMMUNGSTABELLE DES SUB- GENUS SUNIOPS UNTER DEM GENUS EUOPS (COLEOPTERA; CURCULIONIDÆ)

39. BEITRAG ZUR KENNTNIS DER CURCULIONIDEN

Von EDUARD VOSS

Berlin-Charlottenburg, Deutschland

EINE TEXT FIGUR

Die Bestimmung der *Euops*-Arten ist zum Teil recht schwierig, und schon die Abtrennung mancher Arten stösst oft auf erhebliche Schwierigkeiten, weil wichtige Merkmale zur Unterscheidung nur beim Männchen aufzufinden oder hier wenigstens besonders auffällig ausgebildet sind. Es war daher ein glücklicher Umstand, dass sich im Material C. F. Baker's, besonders aber in der vom Zoologischen Museum Berlin erworbenen reichen Moserschen Sammlung manches die bisherige Kenntnis der

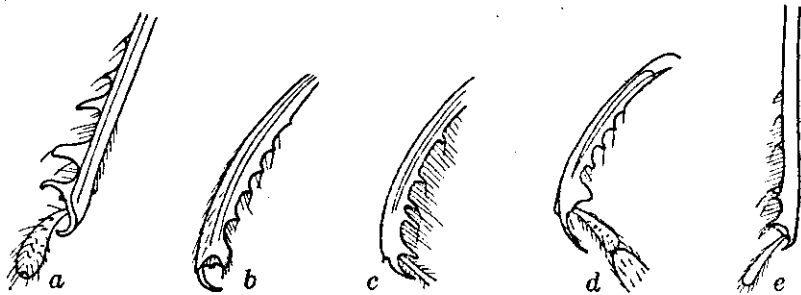


FIG. 1. Aussenzähnelung der männlichen Vordertibia. a, *Euops viridifusca* m.; b, *E. jucunda* sp. nov.; c, *E. dentata* m.; d, *E. cuprea* sp. nov.; e, *E. parvula* sp. nov.,

Untergattung *Suniops* erweiternde Neue fand. Die Arten dieser Untergattung sind an den gezähnten Schenkeln von den übrigen Untergattungen leicht zu unterscheiden, doch finden sich auf den Philippinen zwei, allerdings recht markante, Arten, die diese Auszeichnung nicht aufweisen, aber doch unter diese Untergattung gestellt werden müssen. Eine einfache Beschreibung der neu erkannten Arten schien mir nicht angezeigt, es wurde daher eine grundsätzliche Überarbeitung dieser Gruppe vorgenommen.

Schon in früheren Arbeiten konnte ein Merkmal herangezogen werden, das den Männchen einiger Arten eigen ist und leicht übersehen werden kann. Und zwar handelt es sich um eine Aussenzählung der Vordertibien neben den fast stets vorhandenen, gereiht angeordneten Höckerchen oder Zähnen der Innenseite. Eine Wiedergabe der Unterschiede in der Zähnelung durch das Wort allein lässt vermutlich die Erkennung nicht so einwandfrei zu, wie eine bildliche Darstellung. Aus diesem Grunde wurden einige Abbildungen eingefügt, die gleichzeitig noch Unterscheidungsmerkmale hinsichtlich der Art der Behaarung beziehungsweise, Bewimperung erkennen lassen.

*a*¹. Schenkel ohne Zähnen; Vorderschenkel in beiden Geschlechtern sehr kräftig, so stark oder fast so stark wie der Kopf breit. Vordertibien des Männchens aussen mit langen Zähnen oder Dornen bewehrt: 1. Gruppe.

*b*¹. Zwischenräume der Flügeldecken so breit wie die Punktstreifen, leicht gewölbt, die Punktierung ziemlich kräftig, dicht, querrunzig verlaufen. Kopf fein und mässig dicht punktiert, zwischen den Punkten ebenso wie an den Seiten des grob und teilweise runzig verlaufen punktierten Halsschildes, der Körperunterseite und an den Schenkeln sehr fein und dicht punktiertchagriniert. Fühler kurz, nur das 4. Geisselglied und das 1. Glied der Fühlerkeule etwas länger als breit. Die Vordertibien des Männchens stark gebogen, der äussere Zahn an der Spitze lang, schwach gebogen, der zweite breit und zweispitzig, der 3. Zahn kleiner. Färbung hell bronzeglänzend; das Abdomen des Männchens in der Mitte kurz abstechend behaart. Länge 3.3 mm. Philippinen, Nord-Luzon, Balabasan (*Boettcher*), März, 1918; Mus. Berlin (coll. Moser).

E. moseri sp. nov.

*b*². Flügeldecken stark grubig punktiert, die Punktgruben wabenartig gegeneinander versetzt, sodass die Zwischenräume sehr schmal gewellt ausgebildet sind; letztere nur mit feinen vereinzelt Punkten besetzt. Die übrige Körperskulptur ähnlich der vorhergehenden Art. Die drei ersten äusseren Zähne mit Ausnahme des zweiten, an der Spitze abgestutzten Zahnes schlank, lang und spitz, die folgenden klein, spitzig. Färbung dunkelbraun; Unterseite mit Ausnahme der Beine metallischgrün und auch der Kopf, die Seiten des Halsschildes und die Flügeldecken in den vertieften Stellen mit metallischgrünem Anflug. Länge 4 mm. Philippinen, Luzon, Benguet, Santo Tomas; Panay, Mount Macosolon; Mindanao, Dapitan *E. viridifusca* m.

*a*². Schenkel mit spitzem Zähnen bewehrt: 2. Gruppe.

*b*¹. Halsschild auf der Scheibe kräftig querrieffig skulptiert.

*c*¹. Hinter dem Vorderrand des Halsschildes sind die Querriefen beiderseits der Mitte kreiselartig angeordnet, sodass Neigung zu einer pustelartigen Aufwölbung dieser Partie besteht. Die Punkte der Streifen auf den Flügeldecken sind scharf quervierrickig ausgebildet, die Zwischenräume sehr schmal, kielartig. Pygi-

dium ziemlich kräftig und sehr dicht punktiert. Färbung schwarzbraun; Vorderrand der Hinterbrust, basale Hälfte der Mittel- und Hinterschenkel sowie die Mitte des Abdomens metallischgrün; Schildchen kupferrot, glänzend. Länge, Weibchen, 4 mm. Philippinen, Mindanao, Butuan (*Baker*). In meiner Sammlung *E. turbaticollis* sp. nov.

c². Das Halsschild auch vorn einfach querriefig skulptiert.

d¹. Körperform länglicher, gestreckter; Flügeldecken etwa ein und ein Viertel bis anderthalbmal so lang wie breit.

e¹. Die apikale Partie der Flügeldecken einfach, normal verrundet, der 3. und 4. Zwischenraum nicht vorgezogen.

f¹. Flügeldecken grob punktiert, die Zwischenräume grobrunzlig skulptiert, gewölbt, so breit wie die Streifen. Vorderschenkel kräftig keulenförmig. Färbung schwarz, Oberseite mit Erzglanz, unterseits metallisch glänzend; Schildchen kupferrot; Schenkel hellrot, Tibien und Tarsen rot mit bläulichem Schein. Länge, 3.5 bis 4.2 mm. Philippinen, Luzon, Benguet, Baguio, Santo Tomas.

E. elongata m.

f². Punktstreifen der Flügeldecken fein; Zwischenräume flach und viel breiter als die Punktstreifen, die ganzen Decken gleichmässig fein querrunzlig skulptiert, die Querrunzlung kräftiger als diejenige des Halsschildes. Kopf fein und dicht punktiert, der Untergrund ebenso wie die Zwischenstege der seitlichen groben Punktierung des Halsschildes sehr fein und sehr dicht matt punktiert. Erstes Geisselglied kräftig, oval, etwas länger als breit; Glied 2 bis 6 an Länge wenig verschieden, länger als breit; 7. Glied quer. Erstes Glied der Fühlerkeule so lang wie breit; 2. und 3. Glied quer; das Endglied kurz kegelförmig. Färbung schwarz; oberseite nur mit schwachem Erzschein, Unterseite stärker metallisch glänzend; Schildchen leuchtend grün. Länge, Weibchen, 3.5 mm. Philippinen, Nord-Luzon, Mount Data (*Boettcher*), März, 1917. Mus. Berlin (coll. Moser)..... *E. cribraria* sp. nov.

e². An der Spitze der Flügeldecken ist der 3. und 4. Zwischenraum vorgezogen, sodass die Decken bei der Schrägaufsicht ausgehöhlt erscheinen; da die Zwischenräume hinten stark gewölbt sind, ist der Deckenabsturz scheinbar gekerbt. Kopf fein und weitläufig punktiert, mit sehr feiner, gedrängter Zwischenpunktierung, die auch auf den Zwischenstegen der seitlichen, grubenförmigen Halsschildpunktierung festzustellen ist. Die Punktgruben sind seitlich nur im Übergang zur Querriefelung runzlig verlaufen. Die vier ersten Geisselglieder länger als breit; das erste kräftig, oval; 5. bis 7. Glied nur so lang wie breit. Erstes und 2. Glied der Fühlerkeule so lang wie breit; 3. Glied quer. Punktstreifen der Flügeldecken kräftig, die Punkte etwas wabenartig gegeneinander versetzt; die Zwischenräume kommen nur hinten zur Entwicklung. Färbung schwarz mit Erzglanz;

Schildchen dunkelgrün. Philippinen, Nord-Luzon, Balabasan (Boettcher), März, 1918. Mus. Berlin (coll. Moser).

E. apicalis sp. nov.

*d*². Körper von normaler Gestalt, die Flügeldecken kaum länger als breit, durchaus regelmässig punktiert gestreift.

*e*¹. Zwischenräume der Flügeldecken flach, jedoch nach innen, zur Naht hin, schräg abfallend geneigt; die Punktstreifen innen vom Zwischenraum scharf begrenzt, nach aussen frei auslaufend, (die Punkte der Streifen gewissermassen schräg von der Seite eingestochen).

*f*¹. Grössere Art, über 4 mm gross. Zwischenräume der Flügeldecken kräftiger querrunzlig verlaufen skulptiert, dazwischen feiner unregelmässig punktiert; Zwischenräume breiter als die Streifen. Vordertibien des Männchens aussen mit kräftigeren Zähnen bewehrt. Färbung metallisch grün, Tibien, Tarsen und zum Teil die Vorderschenkel stahlblau; Halsschild und Flügeldecken dunkler grün, letztere bisweilen von der Basis aus purpurrot übergossen. Philippinen, Mindoro, Calavite; Luzon, Benguet, Santo Tomas *E. schultzei* m.

*f*². Tiere höchstens 3.5 mm lang.

*g*¹. Pygidium kräftig und sehr dicht, etwas runzlig verlaufen punktiert. Halsschild mässig stark und gleichmässig gerundet nach vorn verschmälert; in der Querriefelung sind die Punkte noch sichtbar. Färbung grünlichblau. China, Tonkin *E. blanda* m.

*g*². Pygidium feiner, nie runzlig punktiert.

*h*¹. Schildchen hinten gerade abgestutzt oder schwach konvex gerundet.

*i*¹. Kopf hochglänzend und unpunktiert. Vordertibien des Weibchens breit und an der Spitze stark einwärts gebogen. Halsschild auf der Scheibe vorn fein und dicht punktiert; Zwischenräume der Flügeldecken fein und dicht ein- bis zweireihig punktiert. Unterseits metallischgrün, oben blau gefärbt. Sumatra, Sibolangit *E. gratiosa* m.

*i*². Kopf meist weniger glänzend, mehr oder weniger stark punktiert, oft zwischen den Punkten mit sehr feiner und dichter, mattierender Grundpunktierung.

*j*¹. Tier hochglänzend, die Zwischenräume schmal rippenartig erhaben. Färbung metallischgrün, Flügeldecken teilweise blau, Fühler, Tibien und Tarsen dunkelbraun. Celebes *E. plicata* Pasc.

*j*². Tiere weniger glänzend, oft matt; die Zwischenräume nicht hochglänzend, kielartig erhaben.

*k*¹. Tibien des Männchens aussen vor der Spitze mit einigen entfernt stehenden langen Zähnen bewehrt.

*l*¹. Vordertibien des Männchens an der Spitze mit kräftigem, breitem, abgestutztem Lappen, dahinter reihig gezähnt. Halsschild seitlich

kräftig gerundet, Vorderrand mässig verschmälert, kräftig querrieffig ohne Zwischenpunktierung.

*m*¹. Zwischenräume kräftiger quengerunzelt, an der Aussenkante dicht einreihig punktiert. Halsschild zur Basis weniger verschmälert. Rüssel doppelt so lang wie breit. Kopf ohne kräftigere Punkte, nur mit sehr feiner, matter Grundpunktierung. Vordertibien des Männchens an der Spitze aussen mit einem breiter abgestutzten Lappen. Länge 3 bis 3.5 mm.

*n*¹. Unterseite metallischgrün, Halsschild oberseits bräunlich olivgrün, Basis der Flügeldecken kupferrot; Schildchen grün; Färbung im übrigen schwarzblau. Philippinen, Mindoro, Mount Calavite (W. Schultze); Mindanao, Davao (Baker, 6787). In meiner Sammlung, United States National Museum.

E. jucunda sp. nov.

*n*². Färbung schwarzblau, Vorderhüften und die basale Hälfte der Hinterschenkel grün. Nord-Luzon Balbalan; Butae (Boettcher), Januar, 1917. Mus. Berlin (coll. Moser).

E. jucunda forma *obscura* f. nov.

*m*². Zwischenräume nur sehr schwach querrunzlig, glänzend, fein entfernt stehend einreihig punktiert. Halsschild zur Basis mehr verschmälert, seitlich kräftig gerundet. Kopf glänzend, mit feinen Punkten weitläufig besetzt. Vordertibien des Männchens vor der Spitze mit mehr zugerundetem Lappen versehen. Rüssel kurz, höchstens anderthalbmal so lang wie breit. Färbung einfarbig kupferglänzend. Länge 2.5 mm. Philippinen, Nord-Luzon, Cabugao (Boettcher) Februar, 1918. Mus. Berlin; in meiner Sammlung..... *E. cuprea* sp. nov.

*l*¹. Vordertibien des Männchens aussen an der Spitze in einen einfachen Stachel ausgezogen, dahinter weitläufiger kräftig gezähnt.

*m*¹. Die Vordertibien des Männchens sind aussen ziemlich lang und dicht bewimpert, die Wimperhaare doppelt so lang wie die Zähne hoch. Vordertibien des Männchens mit vier langen Zähnen und einem kürzeren Höcker. Halsschild viel breiter als lang, der Vorderrand nur halb so breit wie das Halsschild an der Basis. Punktstreifen

der Flügeldecken stark; Zwischenräume viel schmäler als die Streifen, fein und dicht punktiert. Färbung unterseits metallischgrün, Oberseite schwarzbraun bis schwarz; Schildchen und die Basis der Flügeldecken grün. Philippinen, Luzon, Mount Maquiling; Leyte, Santa Cruz (*Boettcher*), Oktober, 1915 *E. dentata* m.

*m*¹. Vordertibien des Männchens aussen mit einem langen Dorn an der Spitze, einem Doppelhöcker und drei feineren Kerbzähnen bewehrt. Kopf sehr fein chagriniert, ohne sichtbare Punkte. Halsschild ziemlich gleichmässig gerundet, der Vorderrand nur wenig schmäler als die Basis. Punktstreifen feiner, die Zwischenräume etwas schmäler als die Streifen, fein querrunzlig. Färbung unterseits metallischgrün, oberseits dunkelblau; Schildchen, Schultern und Basis der Flügeldecken grün. Länge 2.2 mm. Philippinen, Mindoro, Mangarin (*Boettcher*) November, 1917. Mus. Berlin (coll. Moser), Weibchen; in meiner Sammlung, Männchen..... *E. parvula* sp. nov.

*k*¹. Vordertibien des Männchens vom apikalen Zahn bis über die Mitte hinaus gleichmässig abnehmend gehöckert; lang und gleichmässig gebogen. Färbung schwarz, teilweise grün metallisch überlaufen; Fühler pechbraun; Flügeldecken bis auf die Basis und Schultern blau. Bat-chian, Sula *E. ærosa* Pasc.

Eine Form mit gleichmässiger gezähnten Tibien, sonst kaum verschieden. Philippinen, Mindanao, Momungan (*Boettcher*), Februar, 1915. Mus. Berlin (coll. Moser).

E. ærosa forma *mindanaoensis* f. nov.

*k*¹. Vordertibien des Männchens aussen nur wenig oder gar nicht stärker als die innere Leiste gezähnt.

*l*¹. Kopf fein querrissig oder punktiert mattiert, ohne erkennbare eingestochene Punkte. Halsschild vor der Basis breiter als an der Wurzel.

*m*¹. Punktstreifen kräftig, Zwischenräume sehr schmal. Vordertibien des Männchens gleichmässig gebogen mit deutlich sichtbarer kräftiger Aussenzähnelung. Färbung metallischgrün; die Flügeldecken mit Ausnahme der Basis und des Schildchens schwarzbraun bis schwarzblau gefärbt; Fühler pechbraun. Philippinen, Luzon, Mount Maquiling, Mount Banahao, Mount

- Bulusan, Los Baños; Mindanao, Butuan, Surigao; Mindoro, Mangarin.... *E. boviei* m.
- m*¹. Punktstreifen feiner, die Zwischenräume fein querrunzlig skulptiert, zwischen den Runzeln mässig dicht einreihig punktiert. Vordertibien des Männchens nur im apikalen Drittel kräftig gebogen, ohne erkennbare Aussenzähnelung, erheblich schlanker als bei der vorhergehenden Art. Die grösste Breite des Halsschildes liegt kurz vor der Basis, nach vorn ist es stark verjüngt. Färbung unterseits metallischgrün, oben kupferglänzend; Beine und Fühler gelbrot, die Schenkel jedoch mit grünmetallischem Schein. Länge 2.5 mm. Philippinen, Macba (*Boettcher*), Januar, 1917. In meiner Sammlung..... *E. cupripennis* sp. nov.
- l*². Kopf mit deutlich eingestochenen Punkten.
- m*¹. Punktstreifen der Flügeldecken kräftig; Zwischenräume sehr schmal.
- n*¹. Halsschild an der Basis kräftig verschmälert; Pygidium weniger dicht punktiert. Vordertibien des Männchens länger, gebogen. Kopf und die Zwischenstege der Halsschild-Punktierung mit feiner, sehr dichter Grundpunktierung. Rüssel etwa anderthalbmal so lang wie breit; Fühler vor der Basis eingelenkt. Schaftglied länglich oval, fast doppelt so lang wie breit; 1. Geisselglied gut halb so lang wie das Schaftglied; 2. bis 4. Glied wenig kürzer als das 1. Glied; 5. Glied noch länger als breit; 6. und 7. Glied so lang wie breit. Erstes und 2. Glied der Fühlerkeule so lang wie breit. Färbung schwarzbraun, Fühlergeissel, bisweilen einschliesslich der Keule, und die Tarsen rotgelb; Basis der Decken, Schildchen und Pygidium grünmetallisch. Philippinen, Siargao, Dapa Calundag; Süd-Luzon, Mount Maquiling; Samar, Catbalogan; Polillo; Mindanao, Momungan, Butuan (*Boettcher*), Februar, 1911, April, August und Oktober 1915, 1916. Mus. Berlin, United States National Museum; in meiner Sammlung.

E. rufitarsis sp. nov.

Zuweilen die Unterseite und die Punkte des 3. bis 5. Streifens metallischgrün. Länge 2.7 bis 3 mm.

E. rufitarsis forma *viridisticta* f. nov.

Färbung tiefblau, Tarsen dunkler braun. Mindanao, Port Banga (*Boettcher*), Januar, 1915.

E. rufitarsis forma *cyanea* f. nov.¹

- n*². Halsschild an der Basis nicht verschmälert, sondern von hier gleichmässig gerundet nach vorn verjüngt; in den Querriefen des Halsschildes sind die Punkte deutlich erkennbar. Zwischenräume der Flügeldecken breiter, schwächer gerunzelt. Pygidium sehr dicht punktiert. Vorder-tibien des Männchens gerade, ähnlich den weiblichen Tibien gebildet, doch schlanker; Aussenzähnelung sehr fein bis zu einer unvermittelten Verschmälерung der Tibien im basalen Drittel durchgeführt. Färbung metallischgrün, die Flügeldecken leicht bläulich überhaucht.

Philippinen, Luzon, Atimonan (*Boettcher*), August, 1915; Tayabas, Nueva Ecija, Mount Caraballo, Los Baños.

E. willemoesi Baer.

- m*². Punkstreifen viel feiner; Zwischenräume breiter und sehr fein, matt skulptiert. Pygidium weniger dicht punktiert; Halsschild seitlich stärker gerundet nach vorn verschmälert als bei *willemoesi* Baer. Vorder-tibien des Männchens aussen etwas stärker gezähnt. Philippinen, Palawan, Binaluan, November und Dezember, 1913; Mindanao, Mangarin (*Boettcher*), November, 1917; Luzon. In meiner Sammlung, Mus. Berlin, Hamburg.

*n*¹. Färbung metallischgrün.... *E. palawana* m.

- n*². Färbung der Flügeldecken mit Ausnahme der Basis bläulich schwarz.

E. palawana forma *tristicula* f. nov.

- n*². Färbung tiefblau, Flügeldecken mit leichtem violetten Schein. Mindanao, Momungan (*Boettcher*), August, 1915. Mus. Berlin (coll. Moser).

E. palawana forma *azurea* f. nov.

- h*². Schildchen hinten konkav, dreieckig ausgeschnitten. Punkstreifen kräftig; Zwischenräume sehr schmal.

¹ Leider liegt nur ein Weibchen vor. Kopf-, Halsschild- und Flügeldecken-skulptur stimmt mit der Nominatform überein, sodass anzunehmen ist, dass es sich um eine Rasse des *rufitarsis* handelt.

- Färbung bräunlich-schwarz, bisweilen unten mit grünem oder erzfarbenem Glanz, zuweilen das Schildchen grün und Kopf und Halsschild purpurfarben. Sumatra, Borneo, Penang *E. scutellaris* m.
- e². Zwischenräume der Flügeldecken flach oder gewölbt, die Punkte nicht schräg oder nicht erkennbar schräg eingestochen.
- f¹. Zwischenräume flach, fein und dicht querrunzlig skulptiert, viel breiter als die Punktstreifen. Halsschild quer, an der Basis nicht verschmälert und von hier nach vorn nur schwach gerundet verschmälert. Kopf nur sehr fein und dicht mattiert punktiert, oben ohne grössere Punkte, nur seitlich dichter punktiert. Färbung kupferfarben, die Flügeldecken dunkler kupferfarben; Schildchen grün; Beine rotbraun mit Kupferglanz; Fühlergeissel rötlich. Länge 2.8 mm. Philippinen, Luzon, Trinidad, in 4000 Fuss Höhe (ex coll. Heyne); Haight's Place (*Boettcher*), März, 1917. In meiner Sammlung, Mus. Berlin (coll. Moser) *E. fuscocuprea* sp. nov.
- f². Zwischenräume der Flügeldecken leicht gewölbt.
- g¹. Vordertibien des Männchens von der Mitte ab stark einwärts gebogen, aussen besonders vor der Mittelpartie fein gezähnt und von hier aus bis zur Spitze länger dicht bewimpert. Punktstreifen kräftiger als bei der folgenden Art. Färbung grünlich metallisch. Länge 2.2 bis 2.6 mm. Philippinen, Luzon, Imugan (*Boettcher*), Juni, 1917. Mus. Berlin (coll. Moser); in meiner Sammlung *E. viridula* sp. nov.
- g². Vordertibien des Männchens nur im apikalen Drittel leicht einwärts gebogen, aussen gleichmässig fein gekerbt; jeder Höcker trägt ein Härchen, zwischendurch mit nur vereinzelt Härchen besetzt. Zwischenräume breiter als die Streifen, fein querrunzlig und zwischendurch vereinzelt punktiert. Färbung der Flügeldecken mehr hellkupferfarben bis messingglänzend. Philippinen, Nord-Luzon, Balbalasan (*Boettcher*), Januar, 1917; Benguet, Santo Tomas. Mus. Berlin (coll. Moser); in meiner Sammlung. *E. semicuprea* m.
- b¹. Halsschild einfach punktiert, nicht oder nur schwach querweilig skulptiert; seitlich meist kräftiger punktiert.
- c¹. Zwischen der Punktierung ist der Untergrund des Halsschilds sehr fein und dicht querrissig grundiert.
- d¹. Punktstreifen etwas feiner und die Zwischenräume schräg nach innen abfallend, fein einreihig punktiert. Fühlerkeule rötlich. Färbung pechbraun bis schwarz; unterseits, die Seiten des Halsschilds, Schultern und Schildchen grün. Banguey Inseln, Borneo, Philippinen *E. anceps* m.
- d². Punktstreifen etwas kräftiger; Zwischenräume so breit wie die Streifen, gewölbt, etwas versetzt punktiert. Fühler pechschwarz. Färbung schwarz mit violetter oder bläulichem

Schein, Flügeldecken blau, Beine pechbraun mit blauem und teilweise grünem Schein; Rüssel, Vorderhüften und Basis der Decken grün. Ceram *E. violacea* Pasc.

- c². Der Untergrund des Halsschildes ist glatt und glänzend, nur von vereinzelten Querfurchen unterbrochen. Punktierung besonders nach den Seiten zu kräftiger und dichter. Zwischenräume der Flügeldecken breit und flach; Punkte der Streifen getrennt. Färbung tiefblau oder grünlichblau; Rüssel, Fühler, Tibien und Tarsen schwarz. Philippinen, Mindanao, Surigao, Mai und August, 1915; Siargao, Dapa, Oktober, 1916, Caluntug, Juli, 1916; Leyte, Santa Cruz, Oktober, 1915; Luzon, Mount Banahao (*Boettcher*), April, 1914; Los Baños (*Baker*).... *E. cyanella* m.

ILLUSTRATIONS

TEXT FIGUR 1. Aussenzähnelung der männlichen Vordertibia. *a*, *Euops viridifusca* m.; *b*, *E. jucunda* sp. nov.; *c*, *E. dentata* m.; *d*, *E. cuprea* sp. nov.; *e*, *E. parvula* sp. nov.

CERTAIN FERNS IN SIR JAMES SMITH'S HERBARIUM

By A. H. G. ALSTON

Of the British Museum (Natural History), London

ONE PLATE

1. *DAVALLIA PECTINATA* Sm.

Dr. E. B. Copeland, in a recent letter, drew my attention to the fact that there were probably two species included under this name, and accordingly I consulted Smith's herbarium.

Sir James Smith originally described it as a *Davallia*.¹ His description reads—

7. *D. pectinata*, fronde lanceolata pectinato-pinnatifida: laciniis obtusis undulatis multifloris; infimis auriculatis semipinnatisve.

Habitat in India Orientali, *D. Hurloch* 1786. eandem forte in Otaheite legit Nelson. *H. Banks*.

There are two sheets representing this species in Smith's herbarium. The first, labelled *Davallia pectinata*, contains two collections labelled "1 Malacca. June 1796. Mr. Chrissr. Smith." and "2 Ind. Or.: Soc: Unit: Frat.: 1786," this second collection is evidently the type, and agrees exactly with Gaudichaud's plate of *Nephrodium Gaimardianum*. In Rees's Cyclopaedia XI, Smith calls it "A native of Malacca, the Nicobar Islands, and Otaheite." It seems probable therefore that Smith considered that the "Ind. Or." plant was from the Nicobar Islands. There is also what appears to be a duplicate in Herb. Mus. Brit., labelled "Nicobar Islands? Soc. Unit. Frat." Hurloch was an apothecary through whom plants collected by members of the society (Moravians) were received.²

There is also another sheet labelled "1 Otheite, D. Nelson, H. Banks, 1790." and "2 do. Menzies 1803" on which Smith has written "*D. pectinata* var." This agrees with the figure of *D. pectinata* in Hooker and Greville Icones Filicum 2, t. 139. from a specimen collected in Tahiti by Menzies, except that the fronds are less markedly deltoid. This species is now left without a

¹ Memoires de l'Academie Royale des Sciences de Turin 5 (1793) 415.

² Journ. Bot. (1902) 388.

valid name, as *Humata pectinata* (Sm.) Desv. must replace *H. Gaimardiana* (Gaud.) J. Sm. I, therefore, propose a new name for it, but as Nelson's specimens are poor in both the herbaria of Smith and Banks I propose to regard Bank's own collection, to which Solander gave a manuscript name, as the type.

HUMATA BANKSII sp. nov.

Rhizoma repens, distante radicans, squamosa; squamis lanceolatis, membranaceis, atrofusis, margine pallidiore integre; frondibus singuli dispositis, erectis, glabris, coriaceis, ambitu oblongo-lanceolatis vel ovato-delloideis, profunde pinnatis; pinulis anguste oblongo-lanceolatis, fertilibus crenulatis, inferioribus margine inferiore pinnatifidis; costa distincta; venulae laterales plerumque furcatae; sori submarginales, numerosi, venulorum apicibus singuli dispositi; indusium subreniforme, membranaceum; sporangiis longe pedicellatis.

Tahiti: *Banks 1769* (in Herb. Mus. Brit.).

While searching in Smith's herbarium for the type of *D. pectinata* Sm. I came across the types of several other species which seem worthy of notes.

It seems worth while to give Smith's description of new species published in Rees's Cyclopaedia as they have been overlooked and some of the names are not in Christensen's Index Filicum. The pages are not numbered, and the dates are taken from Jackson.³

2. DAVALLIA PILOSIUSCULA Sm. in Rees Cyclopaedia 11 No. 10 (1808).

10. *D. pilosiuscula*. Frond thrice compound pointed. Leaflets ovate, blunt, decurrent, crenate, hairy. Dots scattered, globose. Cover crenate. Sm. MSS. Communicated by the late Mr. Christopher Smith from Honimoa and Amboyna. Frond large and spreading, rough in every part with short tawny hairs, thrice compounded in the alternate order; the principal divisions taper-pointed; the ultimate ones ovate, blunt, crenate. Dots sparingly scattered, at some distance from the edge of the leaves, small, yellowish, globose, each invested with a turgid, membranous, pale brown or yellowish, cup-shaped, crenate cover.

There are two sheets in Smith's herbarium labelled "Honimoa-July 1797. Mr. Chris. Smith." and "Amboyna-1796. Mr. Chris. Smith." They are clearly the same species, the only difference being that the Honimoa specimen has slightly larger leaflets and fewer fructifications. They represent a species of *Microlepidium* which falls under *M. speluncae* (L.) in the broad sense of Baker, though that species has been subdivided by

³Journ. Bot. 34 (1896) 307-311.

Prantl (in Arb. K. Bot. Breslau I, pp. 25-38), I think the Smith's plant is probably conspecific with the type of *M. speluncae* from Ceylon in Hermann's herbarium.

3. *DAVALLIA SETOSA* Sm. in Rees Cycl. X, No. 18 (1808).

18. *D. setosa*. Frond thrice compound, all over hairy. Leaflets alternate, decurrent, oblong, sinuated. Dots solitary in each sinus bristly. Sm. MSS. Found by Mr. Menzies in the Sandwich islands. The frond is perhaps two or three feet high, triply winged in an alternate order; the leaflets especially are very regularly alternate, decurrent, oblong, bluntish, sinuated so as to be almost pinnatifid. The stalks and whole frond are clothed with fine, bristly, or shaggy, pellucid, jointed hairs. Dots solitary near each sinus of the leaflets, round, brown, the covers concealed or clothed with numerous hairs like those of the frond.

The specimen in Smith's herbarium is labelled "Sandwich Islands. Mr. Menzies, 1803" and is the species commonly known as *Microlepia hirta* (Klf.) Presl; as Smith's name antedates *Davallia hirta* Klf. the species must be known as *Microlepia setosa* (Sm.) comb. nov.

4. *DAVALLIA MICROCARPA* Sm. in Rees Cycl. X, No. 24 (1808).

24. *D. microcarpa*. Frond thrice compound, lanceolate. Leaflets alternate, wedge-shaped, in two or three somewhat elliptical segments, abrupt. Dots in pairs, or solitary, minute. Sent us by the late Mr. Christ. Smith from Amboyna. The whole frond is rather smaller than the last, and lanceolate, the pinnae about the middle part being the longest, these as well as the lower ones, are nearly opposite, but this may be a variable circumstance. The segments of the leaflets differ materially from the last in being somewhat elliptical, and rather contracted at the extremity, which strikes the eye at first sight. The dots, conforming to this contraction, are very small and short. We cannot refer this to any species described by Swartz or Cavanilles, though it is unquestionably allied to some of the following. [The next is *D. chinensis* Sm.]

The specimen in Smith's herbarium is *Odontosoria chinensis* (Linn.) J. Sm.

5. *DAREA PECTINATA* Sm. in Rees Cycl. XI, No. 6 (1808).

6. *D. pectinata*. Frond pinnate. Main-stalks winged upwards. Leaflets crowded, nearly opposite, pinnatifid; segments lanceolate, obtuse, the lowermost palmate. In this beautiful species we are obliged to Mr. Menzies, who found it in the Sandwich islands. It is of a richer green than the foregoing. [*D. furcata* = *Asplenium achilleifolium*.] Frond linear-lanceolate, a foot high, with a short stalk. Leaflets numerous, crowded, nearly if not quite opposite, scarcely above an inch long, linear-lanceolate, bluntish, cut into several lanceolate bluntish segments; all simple, except here and there one which is slightly cloven, and the first at the base of each leaflet at its upper edge, which is palmate. Lines rather longer, and much narrower, than in the last.

There is a specimen in Smith's herbarium labelled "Sandwich Islands. Menzies. 1803. *Darea pectinata*." It is a dareoid form of some species of *Asplenium*.

6. *DAREA MICROPHYLLA* Sm. in Rees Cycl. XI, No. 9 (1808).

9. *D. microphylla*. Frond doubly pinnate. Leaflets doubly pinnatifid; segments uniform, linear. Cover jagged. Brought by Mr. Menzies from the Sandwich islands. The frond is three feet or more in height, far more compound than in any other known species; insomuch that each consists, at a very moderate computation, of at least million of segments; and as ten capsules, if not more, may be reckoned to each segment, one with another, the quantity of seeds produced by each plant will be found so immense, that if they and their offspring were to increase for a few years at the same rate, the land of the whole globe would be covered with this fern, as, according to Linnaeus's computation, the offspring of one haddock would in twenty years fill up the whole ocean. The principal divisions of the frond very much resemble the leaves of *Achillea millefolium*. They are alternate, and alternately pinnate, each pinna being in like manner doubly and deeply pinnatifid, of a dark green; the alternate segments uniform, about a line in length, linear, or somewhat lanceolate, bluntish, often with a minute curved point. Dots dark brown, chiefly on the lowermost segments. Covers broadish, transparent, brown, jagged or crisped.

There is a specimen in Smith's herbarium labelled "Sandwich Islands. Mr. Menzies 1803. *Darea microphylla*."

This species falls under *Asplenium* (*Athyrium*) *aspidioides* Schlect. which Christensen calls *Athyrium scandicinum* (Willd.) Presl. The Hawaiian plant has since been separated as *Athyrium Poirertianum* (Gaud.) Presl and *A. Baldwinii* (Hillebr.). *Asplenium vexans* Heller seems to be the same species, which might be referred to *Asplenium* with equal reason. It may stand as *Athyrium microphyllum* (Sm.) comb. nov.

7. *DAREA HETEROPHYLLA* Sm. in Rees Cycl. XI, No. 12 (1809).

12. *D. heterophylla*. Frond deeply pinnate. Barren leaflets rhomboid, cut and serrated; fertile ones superior, deeply pinnatifid; their segments linear; sometimes forked. A native of New South Wales, near Port Jackson, from whence we received it through the hands of the late R. Molesworth esq. It is one of the finest and most remarkable of its genus. Frond about two or three feet high, of a palish, somewhat glaucous green, smooth, broad, doubly and alternately pinnate. The lower leaflets tilt towards the middle of the frond, are barren, about an inch long, of a broad lanceolate figure, inclining to rhomboid; dilated, lobed, and approaching to auricled, at their base; their margin jagged and serrated: all the upper leaflets of the same dimensions, but very deeply pinnatifid, their segment alternate, linear, acute, entire, some of the lower ones occasionally cloven or forked. The upper edge of each segment is almost entirely occupied by a long line of fructification, whose reflexed, smooth whitish cover is very conspicuous. Capsules very numerous, brown.

There is a specimen in Smith's herbarium labelled "New South Wales. R. Molesworth Esq.: = *Darea* (heterophylla)."

It is the species currently known as *Asplenium dimorphum* Kunze (1850), a native of Norfolk Island: fortunately there is already an *Asplenium heterophyllum* Presl. (1825).

8. *HEMIONITIS STIPITATA* Sm. in Rees Cycl. XVII, No. 8 (1811).

3. *H. stipitata*. Frond undivided, elliptical, ribless, the length of its stalk. Fructification in deep channels.—Sent from Amboyna by the late Mr. Christopher Smith.—*Frond* the length and breadth of the last, [*H. reticulata* Forst.] being about two inches wide and six long, but scarcely falcate; the base is broad, and not much decurrent, with a slight short rib, scarcely discernible, in that part only. The *stalk* is equal in length to the frond or leaf, linear, square, smooth, and naked. Lines of *fructification* disposed as in the last, but those towards the margin are rather more zigzag; all are deeply sunk into the leaf, causing the upper side to project remarkably, in a beautiful sort of net work.

Smith's specimen is *Antrophyum plantagineum* (Cav.) Kaulf.

9. *HEMIONITIS TRILOBA* Sm. in Rees Cycl. XVII, No. 9 (1811).

9. *H. triloba*.—Frond pinnate; leaflets three-lobed, sinuated, taper-pointed, downy, stalked; the lowermost terminate.—Communicated from the Brasils by the late Sir Geo. Leonard Staunton bart. in 1793. It is evidently akin to the last [*H. rufa* Sw.—*Gymnopteris rufa* (L.) Bernh.] of which it might perhaps be deemed a variety, but the whole *frond* is shorter, though the leaflets are larger; they are also hairy and more finely downy, more waved and often sinuated, taper-pointed, three-lobed, sometimes very deeply, at their base; their partial stalks much longer, and the lowermost pair compound or ternate, at least occasionally so. The terminal leaflet is large, very deeply three-lobed. All are of a light green. Lines of *capsules* numerous, but much less crowded, and much more repeatedly forked. This is a most elegant fern, of which we can find no account. It can scarcely be *Asplenium tomentosum*, Lamarck. Dict. V. 2.308, found in Brazil By Commerson and Dombey, which Swartz quotes from the foregoing, and the description of which best agrees with that species.

There is a specimen in Smith's herbarium labelled "Brasil Sr. G. Staunton Bart. 1793—*Hemionitis triloba*." It is *Gymnopteris tomentosa* (Lamk.) Und. as illustrated in Fl. Bras. t. 36 f. 3-4.

10. *HEMIONITIS POLYPODIOIDES* Sm. in Rees Cycl. XVII, No. 11 (1811).

11. *H. polypodioides*.—Frond pinnate, distinct; leaflets sessile, oblong, pointed, pinnatifid; their lobes obtuse, entire.—Gathered in Hispaniola by the celebrated M. Thiery de Menonvilles. We find nothing like it in Plumier. The *frond* is about the size of *Aspidium Oreopteris*, and the innumerable, short decussating lines of capsules give it the aspect of a true Polypodium. The leaflets are less deeply pinnatifid than in *A. Oreopteris*, but otherwise not very unlike that fern. They are smooth, though their stalk and ribs are finely silky.

There is a specimen in Smith's herbarium labelled "*Hemionitis*—St. Domingue thierry.—polypodioides. Th. No. 95." It is a species of *Diplazium* which I am unable to identify with certainty. The specific name *polypodioides* is preoccupied in *Diplazium*.

11. ISOETES UNILOCULARIS Roxb. ex. Sm. in Rees Cycl. XIX, No. 3 (1811).

Smith makes three species of *Isoetes*, including the following new one but omitting *I. coromandelina* Linn. f.

The description reads—

3. *I. unilocularis*. Indian Quillwort.—Roxb. MSS.—Fronds somewhat triangular, erect. Capsules elliptical, if one cell. Sent from the coast of Coromandel by Dr. Roxburgh. Koenig sent what appears certainly to be the same, in a younger state, to Linnaeus by the name of *I. indica*, as found in ponds on a sandy soil, in December. In these latter specimens the root of each is a globose tuber. Fronds about six, erect, straight, slender, obscurely triangular with a broad membranous base. Fructification too young to be discernible. Dr. Roxburgh's specimen consists of separate fronds, larger than the former, as being more advanced, but otherwise exactly similar, the base of each winged with a broad membrane, and lodging on elliptical, slightly compressed, membranous, brownish capsule, from above half an inch to near an inch long, one of cells, whose inside is lined with innumerable compressed membranous stalks, each bearing a beautiful white seed, convex and granulated below, triangular and smooth above. A spongy body, above the capsule, but, in our specimens, disjointed from it, is lodged in the substance of the leaf, and the same is indicated by the figure of the first species in Engl. Bot. in both male and female flowers, as well as by Linnaeus in his *Iter Scanicum*. Having never had an opportunity of tracing the progress of the fructification, we are not certain whether this to be the part called sometimes calyx, sometimes receptacle, but if so the capsule is reversed.

The specimen appears to be a large form of *I. coromandelina* Linn f.

12. LINDSAEA GRANDIFOLIA Sm. in Rees Cycl. XXI, No. 12 (1812).

5. *L. grandifolia*. Frond pinnate; leaflets opposite, elliptic-lanceolate, pointed. Fructification half way between the rib and the margin.—Gathered in Malacca.—We know this merely from a pencil sketch taken by the younger Linnaeus, marked with the native country of the plant, and a note saying it "probably constitutes a new genus, of which Aublets tab. 365 and 366 and an *Adiantum* of Smeathman's, are other species." This was perhaps written at Sir Jos. Banks's; but if so we cannot account for Mr. Dryander's having omitted this species, which appears to be one of the most remarkable of the whole number. The frond consists of two pair of opposite slightly stalked, leaflets, three or four inches long, with a terminal one still longer. A line of fructification lies midway between the rib and the margin, on each side of the former, but none of the lines extend either to the base or the summit, by near an inch.

The drawing is still in Smith's herbarium. It is undoubtedly *Taenitis blechnoides* (Willd.) Sw.

13. *WOODWARDIA FIMBRIATA* Sm. in Rees Cycl. XXXVIII, No. 6 (1818).

6. *W. fimbriata*. Fringed Woodwardia.—Frond pinnate; leaflets sessile, deeply pinnatifid, with spreading, rather acute, lobes, fringed with sharp teeth.—Gathered by Mr. Menzies, on the West coast of North America. This is larger in every part than *W. virginica*, and distinguished from that species by its more acute segments, whose margin is very conspicuously and copiously fringed with prickly teeth, directed towards the point. Groups of capsules large and turgid, ranged, a little obliquely, along the ribs of the segments, from three to five pair on each segment, none at the mid-rib of the leaflet itself. *Involucrum* strongly and permanently vaulted. The bottom lobe of each leaflet at the lower side, is shortened, dilated, and half heart-shaped as is more rarely the case in *W. virginica*. Several of the upper leaflets are decurrent and confluent; the top ones undivided and barren.

There is a specimen in Smith's herbarium labelled "Western North America, Menzies 1803;" and at the British Museum, a duplicate labelled "Northwest coast of America: New Georgia. Mr. Menzies," is a form of the plant commonly called *W. Chamissoi* Brack., the W. American representative of *W. radicans*.

This number of the Encyclopaedia is dated 1819, but Jackson⁴ gives the date as 31 July 1818.

14. *ASPIDIUM BLECHNOIDES* Sm. in Rees Cycl. XXXIX [No. 11] (1818).

[No. 11.] *A. blechnoides*. Long-leaved shield-fern. (*Polypodium exaltatum*; Linn. Syst. Nat. ed. 10. V. 2. 1326. Sp. Pl. ed. 2. 1549; excluding the synonyms, and substituting the following. *Filix minor*, in pinnae tantum divisa, recbras non crenatas, inferiore latere auriculatas, et rotundis pulverulentis, areolas, aversa parte notatas; Sloane Jam. V. I. 86. t. 44. f. 1.)—Frond pinnate; leaflets linear-lanceolate, elongated, entire, with a rounded incurved auricle at the base on the lower side, and a slight dilatation on the upper. Masses of capsules in a double row. Native of Jamaica, on the sides of hills. Linnaeus received his specimen in Brown's herbarium, with an erroneous reference to Sloane's t. 31, which belongs to our last described [*A. exaltatum* Sw.]. Hence there has always been a confusion respecting these two ferns, which even Dr. Swartz could not reconcile; see his Syn. Filicum, 65, where he cites Sloane's t. 44, but ought to have added fig. 1; as Fig. 2. is *Blechnum occidentale*. The specific name of *Polypodium exaltatum*, being taken from Plumier's & Sloane's account of the foregoing, and that being universally received as *Aspidium exaltatum*, we have not changed its denomination. That name is not at all applicable to the species before us, which is more expressively called *blechnoides*. Its height is only eighteen or twenty inches. Leaflets from four to six inches long, taper-pointed; the lower auricle of each overlap-

⁴ Journ. Bot. 34 (1896) 311.

ping the main stalk, and hooked or curved in a curious manner, not well expressed in Sloane's plate. *Sori* in double rows close to the mid-rib at each side. *Involucrum* perfectly peltate, orbicular, and entire.

The plant figured by Sloane Jam. I. t. 44. f. 1, is in Herb. Sloane 1. p. 94 and is the species now called *Cyclopeltis semicordata* (Sw.) J. Sm.

Linnaeus, in his description of *Polypodium exaltatum* quoted Sloane t. 31, which may be taken as the type. The specimen is in Herb. Sloane, 1, p. 52 and is the species currently known as *Nephrolepis exaltata* (Linn.) Schott.

The following new names were also published in Rees's Cyclopaedia:—

ACROSTICHUM DISTANS (R. Br.) Sm. in Rees Cycl. XXXIX [No. 25].

Based on *Northolaena distans* R. Br. which is the name still in use.

ACROSTICHUM LIMBELLATUM Sm. in Rees Cycl. XXXIX [No. 3].

Based on Plumier Fil. p. 113. t. 129., from Le Morne Rouge, Martinique.

There is no specimen in Smith's Herbarium and his description is presumably adapted from Plumier.

BOTRYCHIUM FUMARIANUM Sm. in Rees Cycl. XXXIV, No. 4 (September, 1819).

Based on *B. fumarioides* Willd.

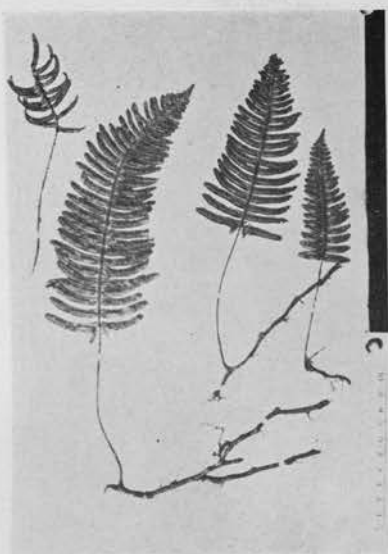
ONOCLEA PENNSYLVANICA Sm. Op. Cit. XXV, No. 3 (1813).

Based on *Struthiopteris pennsylvanica* Willd.

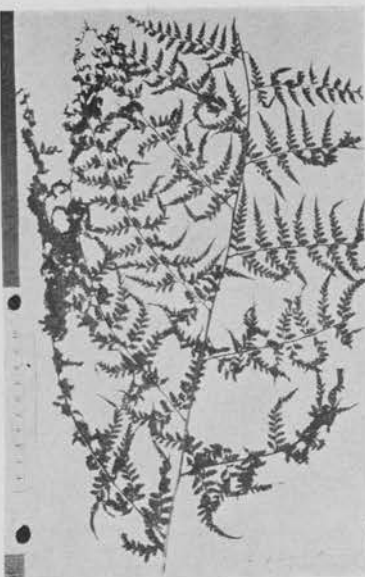
ILLUSTRATION

PLATE 1

- FIG. 1. *Davallia pectinata* Smith, type.
2. *Davallia pilosiuscula* Smith, type.
3. *Davallia setosa* Smith, type.
4. *Woodwardia fimbriata* Smith, type.



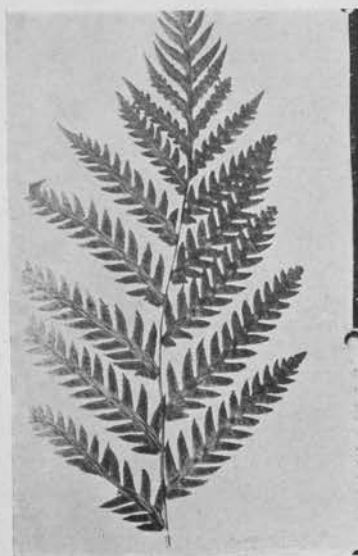
1



2



3



4

SOLAR ULTRAVIOLET RADIOMETRY

I, THE ULTRAVIOLET LIMIT OF SUNLIGHT

By WM. D. FLEMING

*Major, Medical Corps, United States Army; Member, United States Army
Medical Department Research Board, Bureau of Science, Manila*

The short-wave-length limit of sunlight as it reaches the earth is generally taken as about 290 millimicrons.(1, 2, 3, 4, 5) This limit has been found both at sea level and at heights as great as 9,000 meters.(3)

The question as to whether this limit might not be extended in the Tropics has often been raised. Freer and Gibbs(6) made solar spectrographs in Manila in 1910 and concluded that the limit was 291 millimicrons in that place, in close agreement with workers elsewhere.

Since the time that Freer's work was done, a refinement of technic was developed and aëroplanes became available for quickly attaining altitudes above the dust and moisture of sea level. In connection with other work now being done on solar ultraviolet radiometry, it seemed advisable to examine this question again.

The new technic mentioned consists simply in coating the photographic emulsion with a thin layer of mineral oil before exposure. After exposure this oil is washed off with carbon tetrachloride and alcohol; the plate is rinsed in water and then developed as usual. When ultraviolet light strikes the coating of oil it causes this oil to fluoresce. The image is impressed on the emulsion by this fluorescence. This method was developed chiefly for photography of the far ultraviolet, where the gelatine of the plate absorbs the light very strongly. However, its use in the ultraviolet region of 290 millimicrons was thought advisable since it might serve to intensify weak light present in this region.¹

¹ This technic is now so well known it is impossible to trace its origin.

EXPERIMENTAL

All exposures were made with a small quartz spectrograph made by Hilger. The dispersion was such that the spectrum from 190 to 800 millimicrons occupied 9.5 centimeters of which 0.5 centimeter was occupied by the region 280 to 300 millimicrons. Length of spectrum was necessarily sacrificed to attain the portability required for handling the instrument, especially in an *aéroplane*.

Wave lengths were located roughly by the wave-length scale of the instrument, photographed on the plate, and were checked in each instance by a line spectrum of mercury photographed on the plate in close proximity to the solar spectrum, using a mercury arc in quartz as a light source. Eastman 36 plates were used. Development was by Eastman formula D61a. For oiling the plates, liquid petrolatum, heavy, U. S. P. was used.

There was considerable diffuse blackening of the plates due to diffuse light reflected from the prism face. From plate 18 on, this diffused light was cut considerably by a diaphragm of black paper placed in front of the prism, but there was still enough diffuse darkening of the plate extending down into the extreme ultraviolet to render the exact end of the solar spectrum somewhat doubtful. In all cases the termination of the solar spectrum was read as the last Fraunhofer line visible.

Two exposures were made from an *aéroplane* at an altitude of 10,000 feet as read on the standard Army Air Corps altimeter. The planes used were Army Air Corps double-engine bombers. The spectrograph was placed in the nose cockpit; this was done to avoid exposing through any motor exhaust gasses.

RESULTS

The data on the plates exposed are given in Table 1.

Two of the long exposures gave reversed images of the spectrum similar to a positive print rather than the usual negative.

The shortest wave length that could be seen with certainty was 293 millimicrons. This appeared on both *aéroplane* exposures made at 10,000 feet elevation and on one of the Baguio plates at 4,800 feet elevation.

CONCLUSION

No evidence was found that the solar spectrum in Manila and Baguio extends any farther into the ultraviolet than the limit previously found by Freer and Gibbs; that is, 291 millimicrons.

TABLE 1.—Data on plates exposed from aëroplanes.

| No. | Date. | Time. | Place. | Type. | Exposure. | Spectral limit. | Remarks. |
|-----|---------|-------|-----------------------------|------------|---|-----------------|---|
| | 1931 | | | | | $m\mu$ | |
| 13 | Mar. 9 | 10.40 | Manila..... | Oiled..... | Sky; 10 seconds to 10 minutes..... | 295 | |
| 14 | Mar. 10 | 11.00 | do..... | Plain..... | Sun; 10 seconds to 30 minutes..... | 300 | Plate fogged in development. age of long exposures reversed. |
| 15 | Mar. 26 | 11.15 | do..... | Oiled..... | Sun; 5 seconds..... | 297 | |
| 16 | Mar. 29 | 11.00 | do..... | Plain..... | North sky; 1 hour..... | 296 | |
| 17 | Mar. 31 | 11.45 | Laguna de Bay..... | Oiled..... | Sun; 5 seconds..... | 293 | Exposed from aëroplane; 10, feet altitude. |
| 18 | Apr. 1 | 10.30 | Manila..... | do..... | Sun; 60 seconds..... | 294 | |
| 19 | Apr. 6 | 10.30 | do..... | do..... | Sun; 5 minutes..... | 295 | |
| 20 | Apr. 7 | 11.00 | do..... | do..... | Sun; 60 minutes..... | 305 | Image reversed. |
| 21 | Apr. 21 | 11.30 | Corregidor, Manila Bay..... | do..... | Sun; 5 minutes..... | 293 | Exposed from aëroplane; 10, feet altitude. |
| | 1932 | | | | | | |
| 54 | Jan. 7 | 3.30 | Baguio..... | do..... | Sun through thin cloud; 60 seconds..... | 300 | 4,800 feet altitude. |
| 55 | Jan. 9 | 10.55 | do..... | do..... | a. Sun; 75 seconds..... | 293 | Do. |
| | | | | | b. Sun; 120 seconds..... | 293 | Do. |

ACKNOWLEDGMENT

The writer desires to express his appreciation of the cordial coöperation of the personnel of the Air Corps of the Philippine Department in the aëroplane flights performed for this work. In particular, he is grateful to 2d Lt. A. J. Kerwin Malone, Air Corps, United States Army, and to 2d Lt. Wentworth Goss, Air Corps, United States Army, for their piloting of the aëroplanes for the flights made.

REFERENCES CITED

1. CORNU. *Comp. Rend.* 88 (1878) 1101, and 1285; 89 (1879) 808; 90 (1880) 940; 111 (1890) 941.
2. MIETHE and LEHMANN. *Ber. Berlin Akad.* 8 (1909) 268.
3. WIGAND. *Phys. Zeit.* 14 (1913) 1144.
4. FABRY and BUISSON. *Comp. Rend.* 156 (1913) 782.
5. FABRY and BUISSON. *Astrophys. Journ.* 54 (1921) 297.
6. FREER, P. C. *Philip. Journ. Sci.* § B 5 (1910) 13.

CHEMICAL AND BIOLOGICAL ANALYSES OF TIKITIKI EXTRACTS

By A. J. HERMANO and FÉ ANIDO

Of the Bureau of Science, Manila

SEVEN TEXT FIGURES

The purpose of this paper is to ascertain the comparative biological value and chemical analyses of rice-bran (tikitiki) extract prepared by various manufacturers in the Philippine

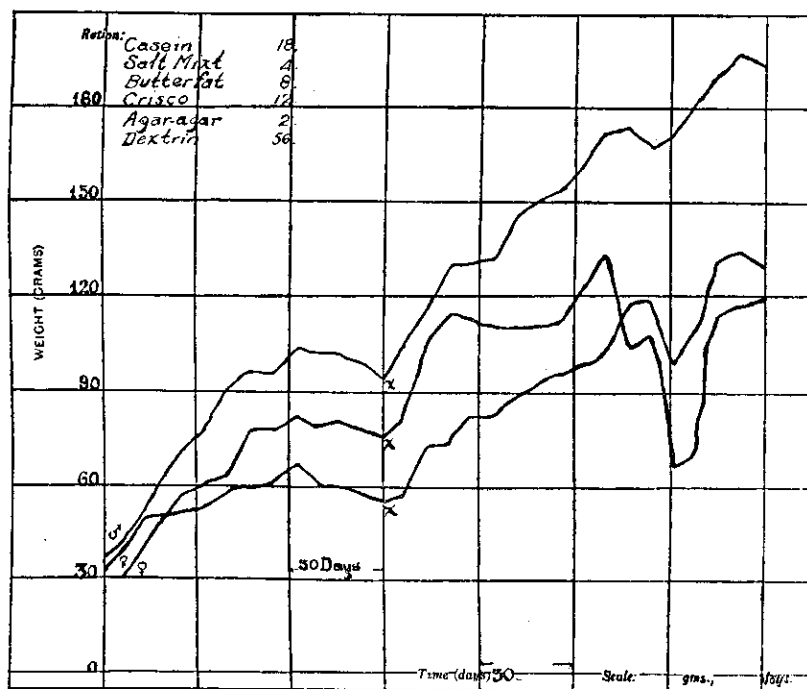


FIG. 1. Weights of white rats. The rats were fed a vitamin-B-free basal diet. At the point x each rat was given daily 0.2 cubic centimeter of brand 1 tikitiki extract. Cage 42.

Islands. Rice polishings (darak), used for making the extract, is a by-product in the milling and polishing of rice. It is composed mostly of the brown coating (pericarp), the germ, tiny particles of broken kernels, and a small quantity of husks. The crude tikitiki is a good feed for hogs, horses, chickens, pigeons,

etc., and the very fine and nonrancid kind, mixed with wheat flour makes tasty and nourishing bread, hot-cakes, cookies, muffins, and biscuits.

Tikitiki extract is used extensively in the prevention and cure of infantile beriberi and, to some extent, of malnutrition of adults. It has been found to be effective in the prevention and cure of polyneuritis in pigeons, chickens, rats, etc.

Wells,¹ working in the Philippine Bureau of Science, published the bureau's method and procedure for manufacturing extract of rice polishings (concentration 1 cubic centimeter = 20 grams crude tikitiki), and according to Santos and Collado,² 0.5 cubic centimeter of this extract is sufficient for a daily supplement of the deficient ration of albino rats. Jansen and Donath³ reported the isolation of a crystalline antineuritic vitamin, from rice polishings to which they ascribed the formula $C_6H_{10}ON_2$, and they stated that 0.5 milligram of their pure antineuritic vitamin corresponds to the potency contained in about 30 grams of rice bran.

MATERIALS

For this investigation crude rice polishings and seven brands of tikitiki extract were used. The crude bran (darak) was the usual quality purchased by the Bureau of Science for the manufacture of the extract. Six rice-polishing extracts were submitted by the Board of Pharmaceutical Examiners and Inspectors, and one extract was the product made by the Bureau of Science.

EXPERIMENTAL PROCEDURE

The chemical analyses of the crude rice polishings and the tikitiki extracts were made according to the methods of the Association of Official Agricultural Chemists.⁴ The generally accepted biologic test for antineuritic vitamin was adopted. The basal ration, test for vitamin B, was prepared and fed to twenty-two albino rats, which were allowed to decline in weight. The animals were given plenty of artesian-well water. After the animals declined in weight each rat was given daily 0.2 cubic centimeter of tikitiki extract as supplement to the antineuritic deficiency in the basal ration.

¹ Philip. Journ. Sci. 19 (1921) 67-73.

² Philip. Agriculturist 14 (1925) 243-245.

³ Mededeelingen Dienst Volksgezondheid Nederlandsch-Indie 16 (1927) 186-189.

⁴ Official and Tentative Methods of Analysis. Association of Agricultural Chemists (1925).

Tables 1 and 2 represent the chemical analyses of the crude rice bran (polishings) and the tikitiki extracts, and text figs. 1 to 7 demonstrate the biological tests on albino rats.

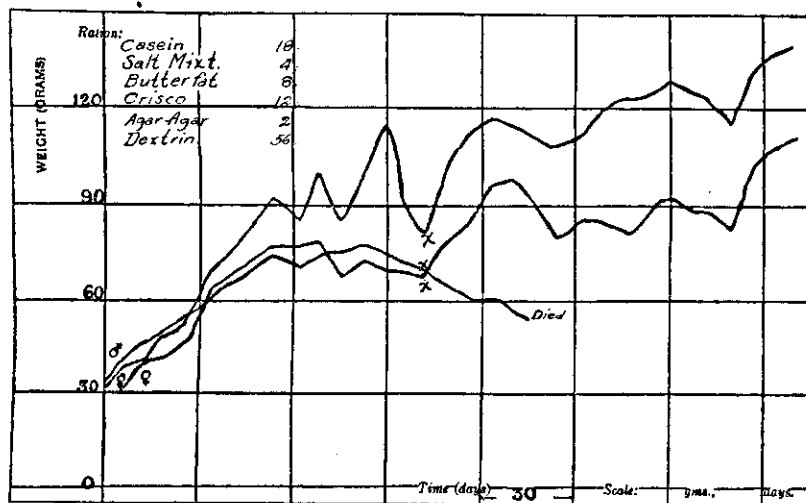


FIG. 2. Weights of white rats. The rats were fed a vitamin-B-free basal diet. At the point x each rat was given daily 0.2 cubic centimeter of brand 2 tikitiki extract. Cage 50.

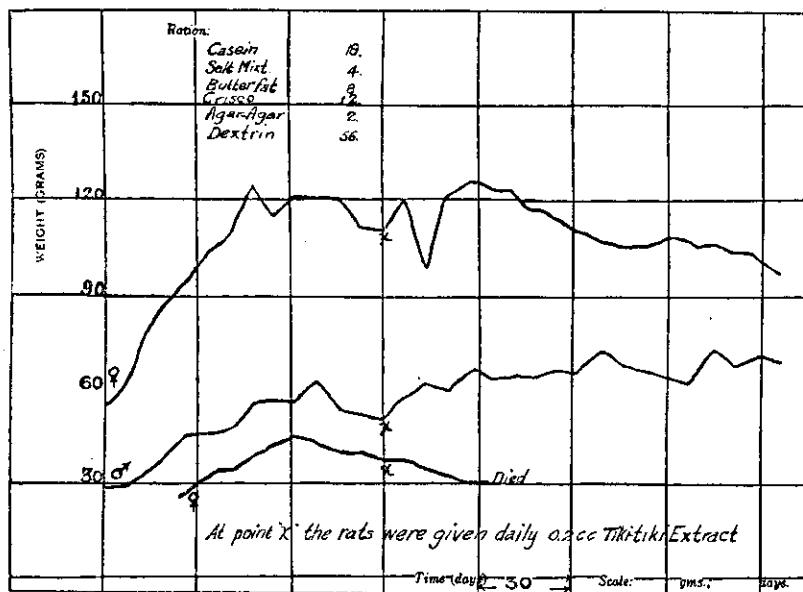


FIG. 3. Weights of white rats. The rats were fed a vitamin-B-free basal diet. At the point x each rat was given daily 0.2 cubic centimeter of brand 3 tikitiki extract. Cage 45.

TABLE 1.—Analysis of rice bran.

| | Per cent. |
|-------------------------------|-----------|
| Moisture | 9.02 |
| Fat (ether extract) | 16.96 |
| Protein ($N \times 6.25$) | 13.81 |
| Ash | 11.94 |
| Crude fiber | 9.91 |
| Carbohydrates (by difference) | 38.36 |
| Total | 100.00 |

TABLE 2.—Chemical analyses of seven brands of tikitiki extract.

| Tikitiki extract; prepared by different manufacturers. | Specific gravity at 27.5° C. | Total solids. | Ash. | Alkalinity of ash in 100 g. sample. | Basic and acid radicals in the ash. |
|--|------------------------------|---------------|-----------|-------------------------------------|-------------------------------------|
| | | Per cent. | Per cent. | g. KOH | |
| Brand 1..... | 1.5592 | 70.68 | 6.70 | 2.15 | Ca, Mg, K, Na, Cl, and S. |
| Brand 2..... | 1.3115 | 71.03 | 5.83 | 2.37 | Do. |
| Brand 3..... | 1.5894 | 65.52 | 8.99 | 0.586 | Do. |
| Brand 4..... | 1.3723 | 61.66 | 4.99 | 0.45 | Do. |
| Brand 5..... | 1.3263 | 45.92 | 4.72 | 1.85 | Do. |
| Brand 6..... | 1.3526 | 65.12 | 4.93 | 2.01 | Do. |
| Brand 7..... | 1.3189 | 70.37 | 3.54 | 0.34 | Do. |

| Tikitiki extract; prepared by different manufacturers. | Nitrogen. | Phosphorus pentoxide. | Sucrose. | Reducing sugars. | | Boric acid, borate, and salicylic acid. | Alcohol. |
|--|-----------|-----------------------|-----------|-------------------|------------------|---|----------|
| | Per cent. | Per cent. | Per cent. | Before inversion. | After inversion. | | |
| | | | | Per cent. | Per cent. | | |
| Brand 1..... | 1.17 | 2.07 | 9.31 | 20.16 | 21.33 | None..... | None. |
| Brand 2..... | 1.77 | 1.52 | 1.57 | 21.64 | 23.39 | do..... | Do. |
| Brand 3..... | 1.30 | 2.70 | 4.09 | 20.21 | 21.22 | do..... | Do. |
| Brand 4..... | 1.09 | 1.84 | 18.13 | 20.34 | 30.92 | do..... | Do. |
| Brand 5..... | 0.66 | 1.49 | 1.77 | 24.62 | 26.84 | do..... | Do. |
| Brand 6..... | 0.68 | 1.58 | 14.21 | 19.16 | 32.41 | do..... | Do. |
| Brand 7..... | 1.21 | 1.68 | 1.27 | 28.35 | 29.99 | do..... | Do. |

DISCUSSION

Administrative Decision No. 170-A, adopted by the Board of Food and Drugs Inspection August 24, 1917, defines tikitiki extract as follows:

Tikitiki Extract is the extract prepared according to the Bureau of Science method from fresh clean rice bran (tikitiki) showing no mold or other signs of deterioration. The extract should contain no substances foreign to the bran.

On analysis the finished extract should show the addition of no substances which lower the strength or therapeutic value of the product; it

should show not more than slight traces of alcohol and should contain no preservatives; it should contain neither less than three (3) per cent nor more than six (6) per cent of total ash; the alkalinity of the total ash from five (5) grams of finished extract should be neither less than four (4) cubic centimeters nor more than six and five-tenths (6.5) cubic centimeters of tenth normal acid using phenolphthalein as an indicator.

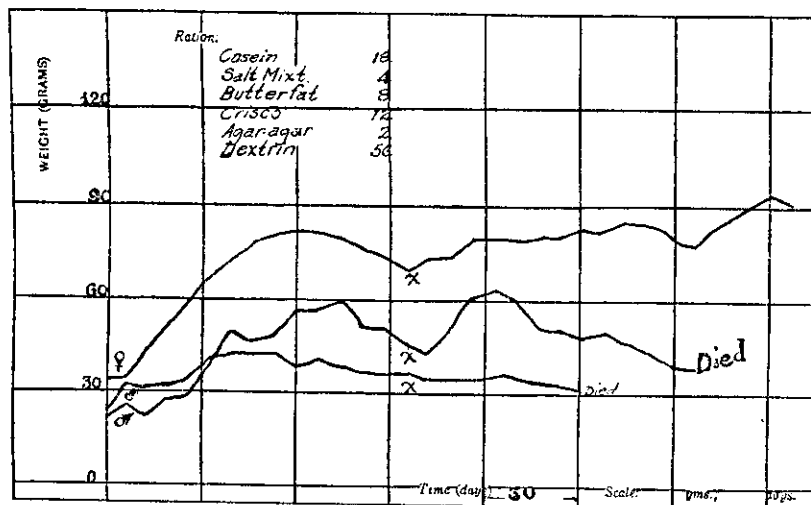


FIG. 4. Weights of white rats. The rats were fed a vitamin-B-free basal diet. At the point x each rat was given daily 0.2 cubic centimeter of brand 4 tikitiki extract. Cage 49.

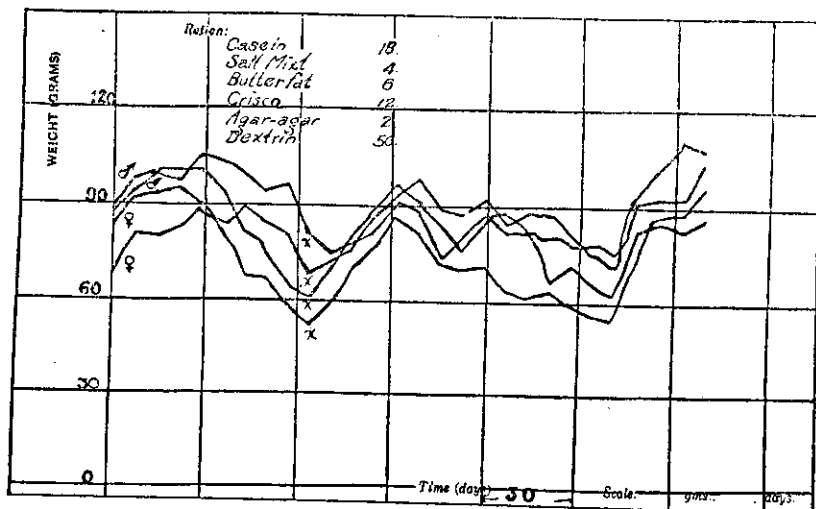


FIG. 5. Weights of white rats. The rats were fed a vitamin-B-free basal diet. At the point x each rat was given daily 0.2 cubic centimeter of brand 5 tikitiki extract. Cage 40.

RESULTS

Results of the chemical analyses recorded in Table 1 show that rice bran has a fairly high fat content, and the protein is also higher than that of polished rice kernels.

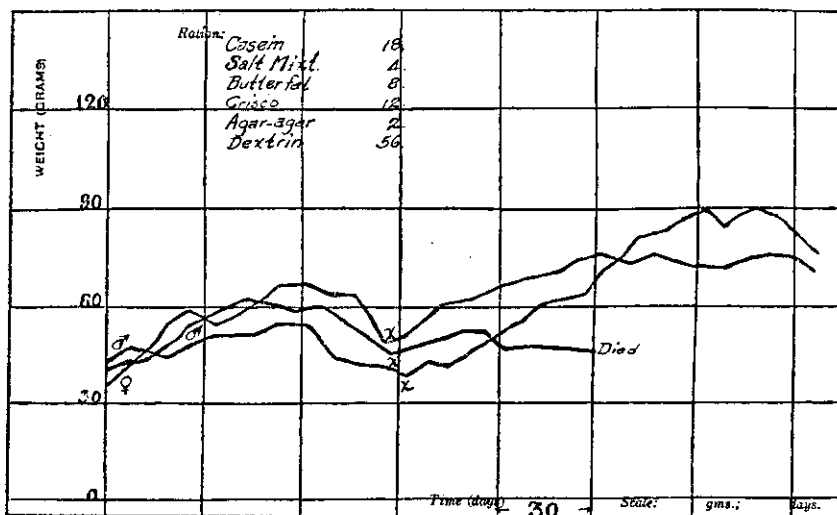


FIG. 6. Weights of white rats. The rats were fed a vitamin-B-free basal diet. At the point x each rat was given daily 0.2 cubic centimeter of brand 6 tikitiki extract. Cage 52.

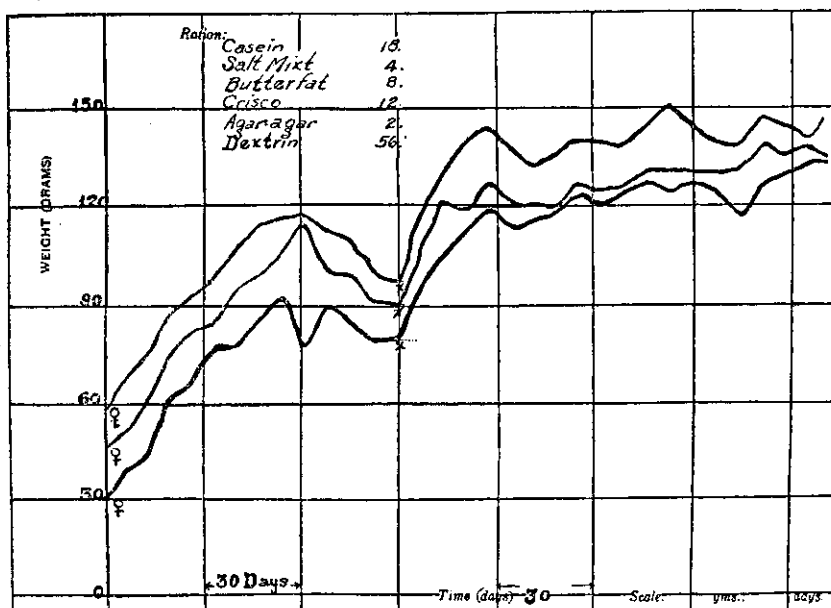


FIG. 7. Weights of white rats. The rats were fed a vitamin-B-free basal diet. At the point x each rat was given daily 0.2 cubic centimeter of brand 7 tikitiki extract. Cage 59.

From the resulting data (Table 2) it is evident that sugar has been added in the preparation of brands 1, 3, 4, and 6.

In carrying out our biological tests four rats out of twenty-two died; and eighteen, which declined in weight due to lack of antineuritic vitamin in the basal ration, were cured and maintained their growth on a daily supplement of 0.2 cubic centimeter tikitiki extract added to the deficient ration.

Brands 1, 5, and 7 were found to be excellent sources of antineuritic vitamin. The charts for brands 2, 3, and 6 demonstrate that the extracts are only a fairly good source of antineuritic vitamin as but two rats out of three were cured.

Brand 4 was not a good source of antineuritic vitamin, as only one rat out of three was cured.

SUMMARY

Chemical and biological analyses were made of rice bran and also of seven samples of tikitiki extract prepared by different manufacturers.

Three samples were found to be excellent sources of antineuritic vitamin. Three samples were only fairly good sources, and one sample was found to contain very little antineuritic vitamin.

ILLUSTRATIONS

TEXT FIGURES

WEIGHT CHARTS OF WHITE RATS USED IN TESTING VARIOUS BRANDS OF TIKITIKI EXTRACT

- FIG. 1. The rats were fed a vitamin-B-free basal diet. At the point x each rat was given daily 0.2 cubic centimeter of brand 1 tikitiki extract. Cage 42.
2. The rats were fed a vitamin-B-free basal diet. At the point x each rat was given daily 0.2 cubic centimeter of brand 2 tikitiki extract. Cage 50.
3. The rats were fed a vitamin-B-free basal diet. At the point x each rat was given daily 0.2 cubic centimeter of brand 3 tikitiki extract. Cage 45.
4. The rats were fed a vitamin-B-free basal diet. At the point x each rat was given daily 0.2 cubic centimeter of brand 4 tikitiki extract. Cage 49.
5. The rats were fed a vitamin-B-free basal diet. At the point x each rat was given daily 0.2 cubic centimeter of brand 5 tikitiki extract. Cage 40.
6. The rats were fed a vitamin-B-free basal diet. At the point x each rat was given daily 0.2 cubic centimeter of brand 6 tikitiki extract. Cage 52.
7. The rats were fed a vitamin-B-free basal diet. At the point x each rat was given daily 0.2 cubic centimeter of brand 7 tikitiki extract. Cage 59.

SEROLOGIC STUDY OF CEREBROSPINAL FLUIDS IN PHILIPPINE MONKEYS INOCULATED WITH YAWS, SYPHILIS, OR BOTH

By ONOFRE GARCIA

*Of the Division of Biology and Serum Laboratory
Bureau of Science, Manila*

That the serologic blood of infected experimental animals is quite similar to that encountered in syphilis and yaws of man has been demonstrated in a long series of serologic examinations.¹

The present report concerns a considerable number of examinations performed on spinal fluids of monkeys that have been inoculated some time previous with yaws, syphilis, or both.² At the time the spinal fluid was examined the animals showed no clinical sign of disease. At the same time that the spinal fluid was withdrawn a sample of blood was secured from each animal. The blood serum and the spinal liquid were simultaneously subjected to the same serologic tests.

TECHNIC OF WITHDRAWING THE CEREBROSPINAL FLUID

The monkey was tied to an animal board, the ventral side down. The occipital region was shaved and cleansed with 95 per cent alcohol. The place where puncture was to be made was disinfected with tincture of iodine, which was later removed with alcohol. The posterior portion of the neck was extended, the helper holding the head down. This position was maintained by placing a small box under the animal's breast.

Taking as a guide the external protuberance of the occipital bone, a hypodermic needle about 3 centimeters long was slowly pushed down into the subdural space in the middle occipital line. If the needle is properly inserted and reaches the cerebral-medullary cistern the fluid comes out freely. As much as 5 cubic centimeters may be obtained in such a way without the slightest injury to the monkey. The animal may occasionally show symptoms of shock, but soon recovers from it.

¹ Philip. Journ. Sci. 35 (1928) 261-272; 40 (1929) 55, 71, 75, 79, 80; 42 (1930) 203-211.

² These animals, inoculated originally in various experiments by Dr. Otto Schöbl and his coworkers, were placed at our disposal by Doctor Schöbl.

TABLE 1.—Showing the results of Wassermann and Kahn tests with the blood serum and cerebrospinal fluid of monkeys. The duration of infection is also given.

| Designation of monkey. | Period between first inoculation and last Wassermann test. | | Last test of the blood serum. | | Cerebrospinal fluid. | | | | |
|------------------------|--|------|-------------------------------|-------|----------------------|-------------|----------|------------------|---------------|
| | | | Wassermann. | Kahn. | Quality of fluid. | Wassermann. | | | Kahn. |
| | | | | | | Alcohol. | Control. | Cholesterinized. | Antigen 0.01. |
| | Yrs. | mos. | | | | | | | |
| Sy-3..... | 2 | 0 | ++ | + | Faintly bloody..... | — | — | ± | + |
| U-1 ^a | 3 | 0 | +++ | ++++ | First bloody..... | — | — | — | + |
| | | | | | Second clear..... | — | — | — | — |
| W-25..... | 2 | 5 | ++++ | ++++ | Faintly bloody..... | — | — | — | — |
| W-23..... | 2 | 5 | ++ | +++ | Clear..... | — | — | — | — |
| W-27..... | 2 | 5 | ++ | ++++ | Faintly bloody..... | — | — | — | — |
| Sy-G-20..... | 1 | 5 | +++ | ++++ | do..... | — | — | — | — |
| Sy-I-11..... | 1 | 4 | ++ | ++ | do..... | — | — | — | — |
| Sy-P-23..... | 0 | 9 | ++++ | — | do..... | — | — | — | — |
| Sy-J-20..... | 1 | 5 | ++ | ± | do..... | — | — | — | — |
| J-11..... | 4 | 5 | ++++ | ++ | Clear..... | — | — | — | — |
| T-4..... | 4 | 2 | ++++ | ++ | do..... | — | — | — | — |
| j-1..... | 1 | 9 | ++++ | ++ | Faintly bloody..... | — | — | — | — |
| E-41..... | 2 | 5 | ++++ | ++++ | Clear..... | — | — | — | — |
| Yac-10..... | 0 | 9 | ++ | ++ | do..... | — | — | ± | — |
| L-13..... | 1 | 4 | ++ | — | do..... | — | — | — | — |
| O-c-1..... | 1 | 4 | ++ | — | do..... | — | — | — | — |
| O-c-2..... | 1 | 4 | ++++ | — | Faintly bloody..... | — | — | — | — |
| Sy-G-22..... | 1 | 6 | ± | — | do..... | — | — | — | — |
| K-25..... | 0 | 7 | ± | — | Clear..... | — | — | — | — |
| K-26..... | 0 | 7 | ± | — | do..... | — | — | — | — |
| Y-G-26..... | 1 | 3 | ++++ | ++++ | Faintly bloody..... | — | — | — | — |

| | | | | | | | | | |
|---------------|---|----|------|------|---------------------|---|---|---|---|
| YB-9..... | 0 | 10 | ++++ | ++++ | Clear..... | — | — | + | — |
| YM-20..... | 0 | 8 | ++ | + | do..... | — | — | — | — |
| f-2..... | 2 | 1 | ++++ | ++++ | Faintly bloody..... | — | — | — | — |
| F-38..... | 1 | 0 | ++ | ± | Clear..... | — | — | — | — |
| K-13..... | 1 | 2 | ++++ | + | Faintly bloody..... | — | — | — | — |
| J-18..... | 2 | 4 | ++++ | ++ | Clear..... | — | — | — | — |
| Z-1..... | 1 | 7 | ++++ | ++ | Faintly bloody..... | — | — | — | — |
| Monkey 1..... | 2 | 0 | — | — | do..... | — | — | — | — |
| L-15..... | 1 | 3 | +++ | +++ | do..... | — | — | — | — |
| K-12..... | 1 | 2 | ++ | ++ | Clear..... | — | — | — | — |
| K-27..... | 0 | 7 | ± | — | Faintly bloody..... | — | — | — | — |
| K-28..... | 0 | 7 | ++ | + | Clear..... | — | — | — | — |
| Sy-D-20..... | 1 | 1 | ++ | + | do..... | — | — | — | — |
| Sy-P-25..... | 0 | 9 | — | — | do..... | — | — | — | — |

a Tested twice.

TECHNIC OF SEROLOGIC TESTS EMPLOYED

The cerebrospinal fluid, whether of bloody appearance or not, was centrifuged before it was subjected to Wassermann and Kahn tests. In the Wassermann test as herein employed alcoholic and cholesterinized antigens, as well as serum controls, were used.* The amount of fluid used for this test varied from 0.3 to 0.5 cubic centimeter.

The Kahn test was performed according to the qualitative procedure with spinal fluid described by Kahn.⁴

DISCUSSION

The duration of infection in the monkeys employed in this investigation varies from seven months to four years.⁵ (See Table 1.) The number and the kind of inoculation received by each monkey are indicated in Table 2. The animals herein employed were inoculated either with yaws or syphilis or both at different periods of time in the form of infection or vaccine treatment, superinfection, or test for immunity to syphilis or yaws. Positive late serologic response was found in the blood serum of most of the animals herein studied. They showed, however, no clinical manifestations of yaws or syphilis at the time the spinal fluid was tested.

Of the thirty-five monkeys whose spinal liquid was examined all but four gave frankly negative results by Wassermann as well as by Kahn tests. The four exceptions showed doubtful or weak positive results. Two samples of the four spinal liquids had admixture of blood which was macroscopically detectible. One of these animals was examined the second time, on which occasion a clear liquid was obtained, and the result of the second examination of the same animal was negative. It is regretted that death of the other three animals that gave doubtful serologic tests in the spinal fluid prevented us from confirming or correcting these findings. In view of the one instance where the result was corrected by repeated examination and on account of the strongly positive results obtained with the blood serum of the animals concerned, the doubtful and weakly positive serologic findings in the spinal fluid of the three remaining animals lack significance.

*Schöbl, O., and C. Monserrat, *Philip. Journ. Sci.* § B 12 (1917).

⁴The Kahn Test (a practical guide). The Williams and Wilkins Co. Baltimore (1928) Chap. 8.

⁵*Philip. Journ. Sci.* 35-43 (1928-30).

RESUME

The cerebrospinal fluids of thirty-five monkeys that were successfully inoculated with either yaws or syphilis or both gave uniformly negative results when tested by Wassermann and Kahn tests. The duration of infection in these animals varies between seven months and four years five months.

Thanks are due to Dr. Otto Schöbl for furnishing me with the material for this study.

The serologic tests of the blood and spinal fluid were performed simultaneously.

TABLE 2.—Showing the number and kind of inoculations received by each monkey at different times.

| Designation of monkey. | Number and kind of inoculations. | | | |
|------------------------|----------------------------------|-----------------|-------------------|---------------|
| | Syphilis infection. | Yaws infection. | Syphilis vaccine. | Yaws vaccine. |
| Sy-3..... | 2 | 1 | 0 | 0 |
| U-1..... | 1 | 4 | 0 | 3 |
| W-25..... | 1 | 7 | 0 | 2 |
| W-23..... | 1 | 7 | 0 | 3 |
| W-27..... | 1 | 7 | 0 | 2 |
| Sy-G-20..... | 3 | 2 | 0 | 0 |
| Sy-I-11..... | 2 | 4 | 0 | 0 |
| Sy-P-23..... | 2 | 4 | 0 | 0 |
| Sy-J-20..... | 2 | 2 | 0 | 0 |
| J-11..... | 2 | 6 | 0 | 0 |
| T-4..... | 2 | 5 | 0 | 0 |
| j-1..... | 1 | 2 | 0 | 0 |
| E-41..... | 1 | 2 | 0 | 1 |
| Yac-10..... | 1 | 2 | 0 | 0 |
| L-13..... | 1 | 3 | 0 | 0 |
| O-c-1..... | 1 | 3 | 0 | 0 |
| O-c-2..... | 1 | 3 | 0 | 0 |
| Sy-G-22..... | 2 | 5 | 0 | 0 |
| K-25..... | 0 | 3 | 3 | 0 |
| K-26..... | 0 | 3 | 3 | 0 |
| Y-G-25..... | 0 | 1 | 0 | 0 |
| YB-9..... | 0 | 2 | 0 | 0 |
| YM-20..... | 0 | 2 | 0 | 0 |
| f-2..... | 0 | 2 | 0 | 0 |
| F-38..... | 0 | 1 | 0 | 0 |
| K-13..... | 0 | 1 | 0 | 0 |
| J-18..... | 0 | 2 | 0 | 1 |
| Z-1..... | 0 | 1 | 0 | (*) |
| Monkey 1..... | 0 | 2 | 0 | 0 |
| L-15..... | 0 | 3 | 0 | 0 |
| K-12..... | 0 | 2 | 0 | 0 |
| K-27..... | 0 | 2 | 0 | 0 |
| Sy-D-20..... | 1 | 0 | 0 | 0 |
| Sy-P-25..... | 1 | 0 | 0 | 0 |

a Tissue from yaws.

AN ARTHROPOD ASSOCIATED WITH A CHRONIC DERMATITIS INVOLVING THE FACE

By CANDIDO M. AFRICA

*Of the School of Hygiene and Public Health
University of the Philippines, Manila*

TWO PLATES

While the dog follicle mite, *Demodex canis* Leydig, causes a severe acariasis in the dog known as red mange, the follicle mite of man, *Demodex folliculorum* Simon, said to occur in 50 per cent of the population in all parts of the world, is generally considered as a harmless parasite. Braun⁽¹⁾ believes that it causes "inflammation of the sebaceous glands (comedones)" and that their "agglomeration in the meibomian glands (in man) sets up inflammation of the margins of the eyelids." Borrel, quoted by Castellani and Chalmers,⁽²⁾ went a step further by believing, though on somewhat slender evidence, that this vermiform acarian is associated with the spread of cancer and leprosy. Herms⁽³⁾ believes that the follicle mite may, under certain conditions, produce acnelike eruption, though it is hardly probable that many, if any, cases of "black-head" may be traceable to this mite. Recently, the writer came across a rather severe case of chronic dermatitis involving the face of an American long residing in the Philippines in which an arthropod answering the description of *Demodex folliculorum* Simon appears to be responsible (Plate 1). Desiring to contribute to the meager literature on the subject, the writer thought it worth while to publish the following case report together with the result of the treatment instituted therein.

CASE REPORT

The subject, J. P., is a male white American, 57 years old, married, native of Pennsylvania, residing in this country since 1899, except for an absence of two years (1917-1919), during which time he served in the American Expeditionary Force in France, where he received mustard-gas wounds which involved

almost the whole left side of the face, the upper lip, and a portion of the right temporal region including parts of the right ear. The lesions healed promptly, but the skin of the parts involved was completely destroyed, thus leaving smooth, unpigmented albinolike areas of granulation tissue which merged very gradually with the surrounding skin. For three years the patient had nothing to complain of except, perhaps, the unsightly look of the scars, which he knew was beyond remedy; but in 1922 he noticed pinhead vesicular eruptions along the borders of the scars which on being pressed yielded a whitish matter of pasty consistency. These eruptions would stay for months in spite of treatment and then would collapse and disappear, only to crop up anew in other parts. The borders of the skin surrounding the scar tissue became undermined, and flakes of crusty matter continued to peel off, now and then, along the course of the eruptions. The eruptions were very annoying, causing an almost intolerable itching, especially during the night, thus causing insomnia.

After having visited various clinics in Manila, where he was treated now and then with various kinds of ointment and lotion for a period of almost ten years, without avail, the patient came to the School of Hygiene and Public Health in October, 1931, to see if something could be done for him. Accordingly, biopsy was advised, and a piece of the affected skin was removed for sectioning. On examining the serial sections, a metazoan parasite, which answers well the description of *Demodex folliculorum* Simon, was found embedded in the hair follicles and sebaceous glands. Prof. William A. Riley, of Minnesota, who happened to be in Manila at the time, saw the sections and he opined that the parasite was most likely a *Demodex*. Efforts were made to tease out whole specimens for study, but all attempts failed.

HISTOPATHOLOGY

The inflammation set up by the invading parasites is essentially a chronic one. The epithelial cells surrounding the parasites appear apparently normal except those that are in immediate contact with the invaders, which are flattened and stretched out forming a kind of epithelial capsule. On closer examination, however, the basal and prickle cells appear markedly swollen or oedematous. They are widely separated from one another, thus rendering the fibrils which under normal condition compactly

bind them together very conspicuous. There is distinct hypertrophy of the epithelial cells. Strands of the proliferated epithelium often dip into the underlying stratum corium and loop out portions of the latter. Thus, islets of white fibrous and yellow elastic tissue appear to be scattered here and there within the epidermis. There is no evidence of round-cell infiltration, and eosinophiles and giant cells are not seen. The horny layer is greatly thickened (hyperkeratosis); it peels off in parts and often presents a dirty scaling mass, which in reality consists of dead hornified epithelial cells, and coagulated plasma that has been allowed to transude by the weakened basal and prickle cells. The affected sebaceous glands are often entirely destroyed and replaced by a deposit of cheesy matter (comedones). Study of the serial sections shows that the tunnels bored by the invading parasites communicate with the exterior.

There is no doubt that the invaders produce a considerable amount of irritation to the surrounding cells, which in the present case had been going on for almost ten years. If it is true, as has been repeatedly alleged, that certain forms of cancer are caused by irritants—chemical, mechanical, or parasitic—acting on the tissues for long periods, Borel's claim that *Demodex* is associated with the spread of cancer seems not to be so far fetched. In this connection it is worth while recalling the lecture of Professor Macleod, of the London School of Tropical Medicine and Hygiene, regarding the probable production of malignant growth in the skin, as follows:

In the epidermis, the only cells that are concerned in reproduction are the basal cells dividing by karyokinesis. The daughter cells never divide under normal condition, but undergo metamorphosis or cornification. If the basal or mother cells are irritated mechanically or otherwise, they produce more daughter cells, and hence an excess of horn cells which are not cast off as rapidly as they are formed (hyperkeratosis of manual hands, corns). The irritant may come from outside, or it may be within the skin, or it may come from the circulating blood as in chronic arsenical poisoning. Arsenic, for instance, secreted by the sweat glands, permeates the epidermal cells, and stimulates the basal or mother cells to active division, resulting in excess of horny cells or hyperkeratosis. The daughter cells under abnormal conditions may be induced to multiply. Epithelioma of the skin has been known to develop as a result of arsenical poisoning.

While it is true that in the present case there is no evidence of malignancy in the tissues examined, the foregoing still suggests the possibility of cancer arising as a result of chronic irritation on susceptible tissues.

TREATMENT

Owing to the fact that the follicle mites occur deeply in the skin, treatment with ointments proved useless. Penetrating materials, such as, benzine, 1 part, and olive oil, 4 parts, or application of tincture of iodine, have been tried by other authors, but the results seem unsatisfactory. Evidently, this organism needs very little air to maintain life, otherwise, by closing the openings of the tunnel in which it lives, as would have happened when ointments were applied on the affected skin, it would have died of suffocation. As the patient had been repeatedly treated for his condition with various kinds of ointment in the clinics and hospitals that he had visited for almost ten years without apparent improvement, it was deemed proper to resort to another method of treatment. The affected parts were exposed to daily ethyl chloride spray until blanched, the spray being continued for a further thirty or sixty seconds at each application. Each part was subjected to seven or eight applications. As the parts affected were quite extensive and as the patient could not stand extensive freezing at each sitting, it took more than forty-five days to cause the death of the parasites and the consequent healing of the lesions. The patient, who expressed genuine satisfaction at the result of this treatment, has not been seen nor heard from since, so that it is not known whether or not a recurrence has taken place.

SUMMARY

An arthropod answering the description of *Demodex folliculorum* Simon has been found associated with a rather severe and chronic dermatitis superimposed on the edges of healed mustard-gas lesions on the face. Biopsy has been performed and the histopathology of the lesions described. Treatment with ethyl chloride spray, which has been found previously to be effective in the treatment of various skin conditions due to metazoan parasites, has been instituted with remarkably favorable results.

PAPERS CITED

1. BRAUN, MAX. The Animal Parasites of Man. John Bale and Sons, Ltd., London (1906).
2. CASTELLANI, A., and A. J. CHALMERS. Manual of Tropical Medicine, 2d ed. William Wood and Company, New York.
3. HERMS, W. B. Medical and Veterinary Entomology, 2d ed. The Macmillan Company, New York (1923).

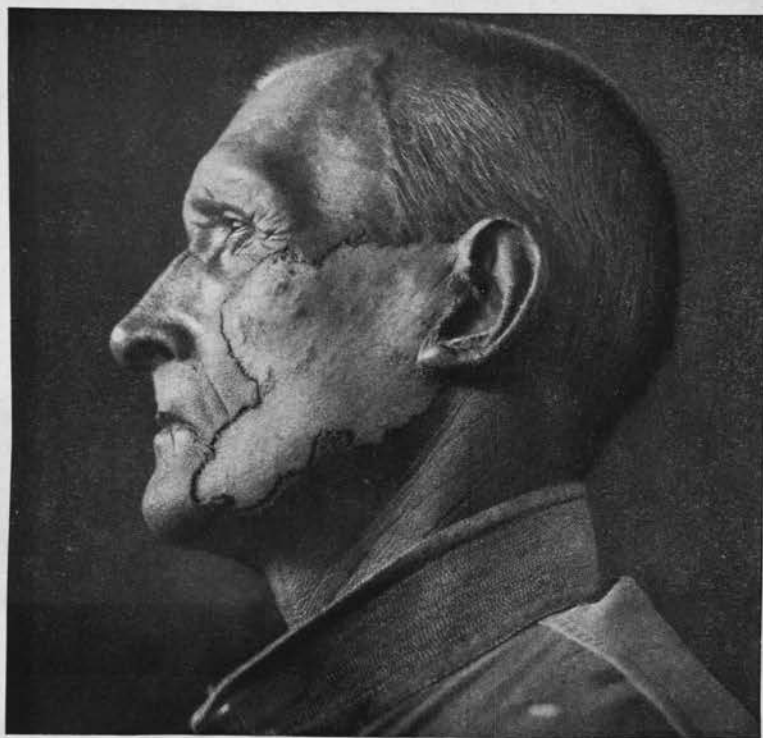
ILLUSTRATIONS

PLATE 1

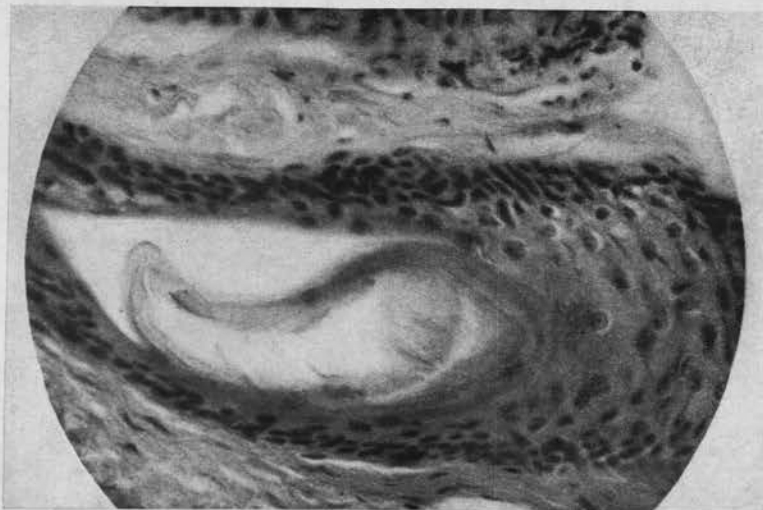
- FIG. 1. The case of facial dermatitis, showing the extensive scar originally caused by mustard gas. The raised, undermined skin at the margin of the scar tissue marks the site of the infestation with the arthropod.
2. A tangential section of the invading arthropod in the hair follicle. Note the mild tissue reaction. $\times 200$.

PLATE 2

- FIG. 1. A cross section of the parasite in the abdominal region. $\times 150$.
2. A section of the parasite near the head region. $\times 150$.

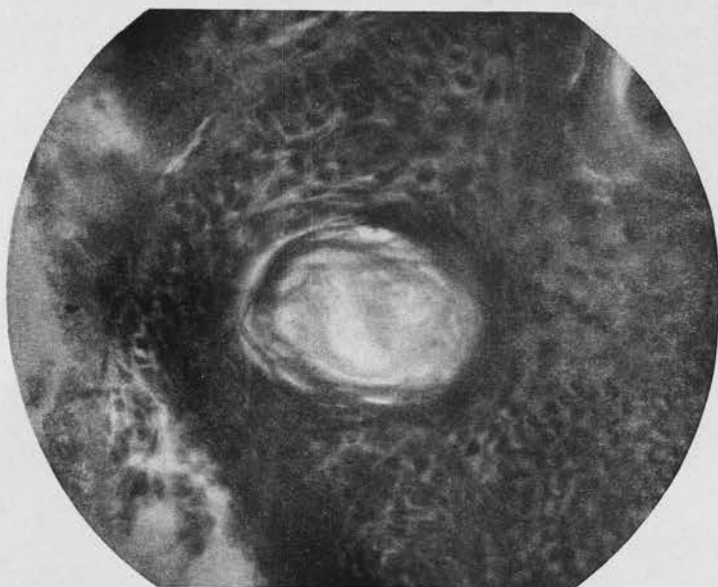


1

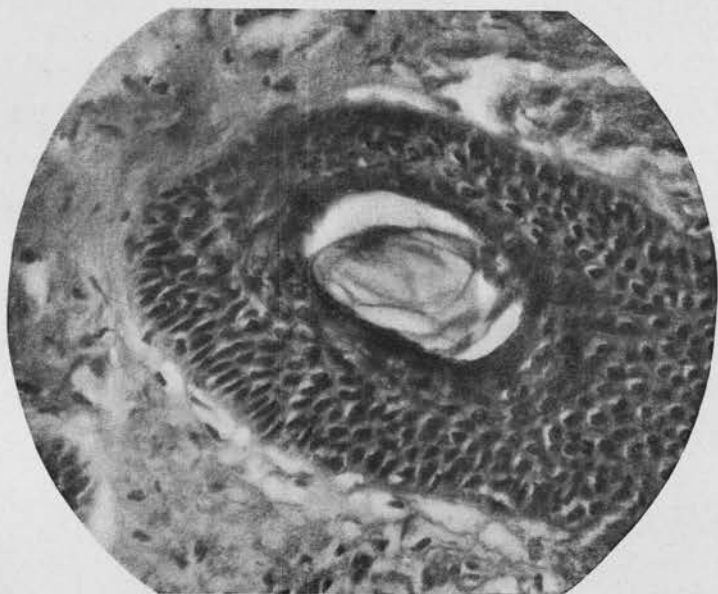


2

PLATE 1.



1



2